049281

JPRS-CST-85-038

5 November 1985

China Report

SCIENCE AND TECHNOLOGY

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NDSTIC FOCUSES ON CORRECT PLACEMENT OF RETURNED STUDENTS

Beijing GUANGMING RIBAO in Chinese 17 Sep 85 p 3

[Article by Staff Reporter Liu Jingzhi [0491 2417 2535]: "National Defense Science, Technology and Industry Commission [NDSTIC] Focuses on Allowing Students Returning From Study Abroad to Specialize in Their Chosen Fields"]

[Text] In the past few years, NDSTIC has shown particular concern for the livelihood of students returning from studies abroad in arranging their work assignments, has suited jobs to their speical training, made use of their studies, provided these students with a way to dedicate themsleves to their country and given full play to their intelligence and wisdom.

On 28 January 1985, the NDSTIC Cadre Department received a letter from returned student Wang Yibing [3769 0076 0365] who asked to be assigned to another post. They immediately sent someone to investigate the matter. They discovered that this gifted student studied and worked at UCLA and University of California Irvine medical schools from May 1980 to January 1983. After receiving specialized "doctorate" training in medicine and physics in January 1982, he also took nine PhD courses in such areas as physical therapy, CT [sic] and radiation therapy. After this he was selected by the University of California Irvine Medical School as a research assistant and engaged in special DAS [sic] research work. When he returned to China, he was unable to use what he had learned at his original unit, and he was hoping that he could be transferred from his original unit and contribute his own strengths in DSA, CT, nuclear medicine and in other respects. After waiting for 1 or 2 years, however, he had not gotten any results.

After the comrades of the cadre department learned of this situation, they quickly discovered through investigation that the 514 Hospital subordinate to NDSTIC was importing DSA, CT and other modern medical equipment from the U.S. and desperately needed talented personnel like Wang Yibing. They then immediately reported this to NDSTIC leaders, received approval, and in less than a month, overcame numerous difficulties and allowed Wang Yibing and his wife to transfer to the 514 Hospital. Wang Yibing was extremely grateful about this matter.

NDSTIC cherishes its returned students and is attentive to giving play to their roles. Not long after this, a Ph.D student who returned from studies

in Germany was assigned to the National Defense Science and Technology University subordnate to NDSTIC. This student studies computer assisted design [CAD], and at the time the National Defense Science and Technology University had not yet officially developed this type of work, while Zhejiang University had officially started it. This PhD student requested to be transferred to Zhejiang University. NDSTIC leaders agreed in order to allow Zhejiang University to give play to this student's wisdom and intelligence. He was immediately transferred to Zhejiang University and started CAD research.

CSO: 4008/2008

NATIONAL DEVELOPMENTS

SCIENCE COMMISSION OFFICIAL ON TECHNICAL MARKET

Beijing LIAOWANG [OUTLOOK] in Chinese No 21, 27 May 85 pp 38-39

[Interview with Guo Shuyan, vice minister of the State Science and Technology Commission, by LIAOWANG reporter: "The Technical Market Must Serve Economic Construction"; date and place of interview not given]

[Text] A brand-new phenomenon--the technical market--is taking shape in China. What is its significance? What is its present state? And what direction will its future course take? All these questions interest more and more people every day. Accordingly our reporter interviewed Guo Shuyan [6753 2885 6056], vice minister of the State Science and Technology Commission, and asked him to respond to some questions relating to the technical market.

Question: Since "The Resolution of the CPC Central Committee Regarding the Restructuring of the Scientific and Technical System" was promulgated, many comrades have shown a good deal of interest in the commercialization of technical achievements without really understanding it. Can you tell us its significance?

Answer: It is only recently that people began to talk about the commercialization of technical achievements, although in practice those achievements have been turned into commodities for some time. As the rural economy flourishes and the restructuring of the urban economy gets under way across the board, the commercialization of technical achievements has become more and more widespread with each passing day.

In the past, technical achievements were turned over without royalties and research projects were chosen with no reference to the marketplace. Everybody did his own thing and the military got separated from the civilian sector. The state assumed total responsibility for scientific research organizations whose only concern was to come up with research achievements, applications being of no interest to them. As a result, scientific research became divorced from production and failed to serve economic construction effectively.

The commercialization of technical achievements and the establishment of a technical market are major policies adopted by the state to implement the principle, "economic construction must rely on science and technology, while scientific and technical work must be oriented toward economic construction," and promote the restructuring of the scientific and technical system.

In the wake of scientific and technical advances, technology is playing an increasingly important role in the creation of social commodity values. More and more technology has been converted into independent intellectual products and new knowledge-based industries are emerging. Hence technical commodities cannot but be conditioned by the law of value as technology is developed, traded and popularized. As technology is increasingly bought and sold, the technical market will become a crucial component of China's socialist integrated market and constitute a link between science and technology, on the one hand, and economic construction, on the other. In the future, other than scientific research devoted to increasing mankind's understanding of the laws of natural and social development, both the development of technology and the application of technical achievements should gradually be brought into the commercial sector.

Question: Specifically, what are the advantages of the commercialization of technical achievements and opening up a technical market?

Answer: It will radically alter the operational mechanism of the technical system. First, it will bring the entire process of technical development into line with market and social needs, from the selection of research projects through popularization to application, and guide scientific research personnel to work hard to solve actual production problems. Second, research units will be made to consider the development of technology in terms of its practical contribution to social economic construction as well as their own economic interests. Third, market competition will compel scientific research units engaged in technical development and applications to come up with better things faster and convert them into productive forces in the real world. Fourth, with the commercialization of technical achievements, he who commissions a project will have to foot the bill, and he who acquires an achievement must pay for it. In this way, the fragmentation between sectors, regions, military and civilians will be brought to an end and the socialization of scientific and technical work facilitated. Fifth, the establishment of the technical market provides a large arena for all talented people who work hard to master a subject. Sixth, the commercialization of technical achievements favors the rational mobility of know-how and skilled personnel. Seventh, as a result of the circulation and application of technology, the idea that "knowledge is worthless" will be discarded and replaced by a widespread respect for knowledge and experts.

Question: Some comrades are concerned that if we go into this technical market business, technical workers will all be tempted to take up short-term projects which yield quick results, thereby affecting the state's key projects and long- and medium-term scientific research tasks. What do you think?

Answer: Their concern is justified to a certain extent. But the problem can be solved provided we take the right approach. Through command planning, the

state, industry and local governments from now on will ensure a place for major scientific research jobs which have a national significance. The state will also use natural science funds to support essential long-term basic research and applied research. Moreover, further steps will be taken to set up a sound system of rewards to make sure that all things being equal, people doing planned research will not earn less than their counterparts who undertake horizontal contractual work.

Question: Can you describe the changes, both in substance and form, which the technical market has experienced after several years' existence?

Answer: The technical market has seen some spectacular growth recently. In 1983, the total value of the technical transfers involving over 3,600 local research institutes was only 1.5 million yuan. In 1984, according to incomplete data from 17 agencies and over 10 provinces and municipalities, as many as 27,000 contracts were concluded with a total value of 290 million yuan. There have been over 8,000 military industrial projects worth 430 million yuan in 15 provinces and municipalities and during the first 3 months of this year, just the "Hangzhou trade fair on the transfer of military industrial technology to civilian use" alone did 1.12 billion yuan worth of business. At the Changsha technical trade fair, contracts worth a total of 104 million yuan were signed while a similar fair in Sichuan resulted in contracts valued at 50 million yuan. The market's explosive annual growth rate points to the following obvious future trends. First, from the simple transfer of a single piece of technology, it has evolved into joint developments and joint ventures in which the parties involved share the benefits and risks. Second, what used to be straightforward inter-unit cooperation becomes one or two units getting together to establish a comprehensive long-term relationship of economic and technical cooperation with a province or municipality. Third, in the past only domestic technical achievements were involved. Now they are joined by imported technology, and domestic research is integrated with the assimilation of imported technology. Fourth, bidding used to be limited to the odd project outside the scientific and technical plan. Now tenders are invited for regular mainstream projects as well. Fifth, previously only single pieces of technology were bought and sold. Today researchers go in for package deals and undertake to deliver an entire project. Sixth, there used to be three players in the game, the buyer, seller and intermediary. Now finance agencies and banks also have a hand in the technical market, supporting it with funds and credit and merging it with the finance market.

Question: The technical market has just come into being and, despite the experience it has gained, still faces many unsolved problems. What policies will the state take regarding the market in the days ahead?

Answer: Briefly, we must further open up our country to the world and invigorate the economy, with the state, the collective and the individual all working together. We must adopt a variety of tools and use multiple channels to develop our technical trade. Governments and relevant agencies at all levels should provide active support and guidance. Specifically, we must first set up a sound legal system for the technical market and promptly draw up regulations to govern the management of the market, the technical

cooperative contract and the confidentiality of technical achievements and to promote the rational mobility of technical personnel, etc. We should take a hard look at policies and regulations made or enacted in the past which are not consistent with the technical market and make adjustments as soon as possible where technical personnel have been wrongly treated. Effective policies and measures should be devised in such areas as pricing, taxes, credit, distribution and so on to nurture the technical market. For example, the market, rather than the state, should regulate the price at which a piece of technology is traded. In other words, the buyer and seller should be left alone to settle the price through negotiation. Also, the transfer of technology has been made tax-free recently and within a specified period of time, the seller of a technical achievement enjoys either a tax exemption or tax reduction. Then, too, the banks are offering a variety of credit terms to support the technical market and the state is encouraging scientific research units to enter into joint operations with factories and mines, using their know-how as capital. In addition, we must mobilize the initiative of the three parties--buyer, seller and intermediary--to the greatest extent possible by safeguarding their legitimate rights and interests. We should handle the distribution relations between the state, the collective and the individual properly by working out the percentage of profits to be retained by the enterprises, the percentage to be remitted to the state, and so on. When a piece of technology changes hands, the benefits derived therefrom can be distributed in three ways. First, if the technology concerned is part of the research plan drawn up by the higher authorities and the research unit in question, the income will belong to the unit and the technical personnel directly involved will receive a reward. Second, if the technology comes from a project initiated by technical personnel in response to market needs, the personnel involved should be even more handsomely rewarded. Units should be supportive of such endeavors. The third scenario is one in which a technical worker goes in for technical development and offers technical services on his own, provided that such activities neither affect his performance in his regular job nor infringe upon the technical and economic interests of his unit. He is allowed to keep the income derived from the transfer. If he needs to use the unit's technical achievements, internal technical data and equipment, he must obtain permission first and hand over part of the subsequent income.

Question: There are still different opinions regarding the issue of technical workers engaging in technical development and offering technical services in their spare time? What's your view?

Answer: Assuming that he performs his regular job satisfactorily, a technical worker is actually making additional contribution to the state and society by undertaking technical development and offering technical services in his spare time. It is a good thing which benefits the country and brings prosperity to the people. That they should be paid for their extra work is reasonable enough. This may also prompt some research units to improve their managerial performance without delay.

Question: Does the boom in the technical market also pose new demands on the work of governments and other agencies at various levels?

Answer: Yes. It is the responsibility of government agencies at all levels to support, nurture and establish all kinds of technical exchange, trade, consultation, service, information and notarization organizations. This is because the technical market is where technical commodities are traded and, like material commodities, technical commodities also need a comprehensive trade system for their effective circulation. Government agencies should also help the market establish an unimpeded market information network and successfully tackle market statistics and forecasting to guide its development. In the future, China's technical market must also link up with its international counterpart. Faced with these two markets, not only must we learn to exploit two kinds of resources and develop and upgrade our technical standard on the basis of what we have learned from imported technology, but we must also use tariffs and other administrative tools to offer limited protection to the domestic technical market.

Technical development agencies, for their part, must adapt to the needs of the technical market. Instead of thinking in terms of a crude "planned research model," they must gradually come to see scientific research as a "business." They must cultivate a strong market orientation, develop a business perspective and a strong sense of competition, establish and perfect their operational setup and technical service system, improve the quality of their personnel, enhance their versatility and unleash an endless stream of competitive products. This requires that they do an excellent economic as well as technical job: not only must they solve problems which crop up during research, design and trial-manufacturing, but they must also handle such stages as popularization, application, batch process and exchange skillfully. It is often not possible for one unit to look after the entire process from beginning to end on its own. To do that it needs good coordination between itself and other parties and other joint operations.

A change in concept is also necessary if we are to meet the developmental needs of the technical market: the old contempt for business operations must go. Through hands-on experience, we should develop a crop of skilled people who are technically and economically competent, who are adept at running a business as well as proficient in technology and who have the spirit of a pioneer.

The technical market is a brand-new phenomenon. We must liberate our ideas and have the courage to innovate and experiment on the one hand, and strengthen our research, take realities as our point of departure and provide careful guidance, on the other, in order to solve new problems as they appear.

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CSO: 4008/2034

NATIONAL DEVELOPMENTS

CHINA'S TECHNICAL IMPORTS MORE THAN DOUBLE

Tianjin JISHU SHICHANG BAO [TECHNOLOGY MARKET WEEKLY] in Chinese 13 Aug 85 p 1

[Article by Yao Wenping [1202 2429 5493]: "Substantial Increase in China's Technical Imports In The First Half of 1985"]

[Text] During the first half of 1985, 318 technical import contracts were examined and approved by the Ministry of Foreign Economic Relations and Trade, a 230 percent increase over the same period last year. Valued at more than $2 billion, they represent a 540 percent increase in terms of dollar value over January through June 1984. An even more rapid increase is projected for the latter half of the year.

The contracts, concluded by various provinces, municipalities and departments with foreign businessmen, cover a wide area and involve all types of technology. Among the more important contracts are those with Japan for cooperation in color videotape recorder technology; with Britain for the purchase of a digital communication system and with the Federal Republic of Germany for the purchase of a 2050 mm hot rolling mill, as well as an agreement with the United States for the purchase of a marine satellite ship. In most cases cooperation takes the form of licensed trade contracts, joint production contracts and consulting and technical service contracts, which between them account for over 50 percent of all contracts, a substantial increase over the corresponding period in 1984. As for the substance of cooperation, most contracts involve product technology or manufacturing technology.

Below are the characteristics of contracts approved by the Ministry of Foreign Economic Relations and Trade during the first half of this year:

(1) The contract negotiations have been short and deals were clinched fairly quickly. This is because coastal cities, cities given more autonomy and provinces in the interior have all conducted various studies and increased foreign contacts and technical exchanges in accordance with the state's technology import and technical modernization plans.

(2) There has been a sizable increase in the number of contracts reached with European nations and in their overall dollar value. During this period we concluded the most contracts with the Federal Republic of Germany, 69 with a

total price tag of $600 million. It placed third last year. Our contracts with Britain also jumped 100 percent over the same period last year.

(3) Because we have strengthened the management of technology import and paid attention to information circulation, some unnecessary duplication has been eliminated. For instance, two textile knitting factories, in Wuxi and Suzhou respectively, wanted to import the same kind of knitting needle technology and equipment. After coordination, the Suzhou factory decided to cancel its purchase.

(4) There has been a greater consciousness of using domestic components throughout the import process, from need identification to the signing of a contract. For instance, two light industrial machine plants in Nanjing and Hefei, which are directly under the Ministry of Light Industry, imported cold beverage bottling technology and have now manufactured four production lines, 70 percent of whose parts are made in China.

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CSO: 4008/2034

NATIONAL DEVELOPMENTS

GREATER AWARENESS OF PATENTING URGED

Tianjin JISHU SHICHANG BAO [TECHNOLOGY MARKET WEEKLY] in Chinese 27 Aug 85 p 3

[Article by Liu Xiaowei [0491 1420 3634]: "Engineering and Technical Personnel Must Familiarize Themselves With Patenting"]

[Text] Nowadays patenting is no longer a remote, strange concept. Whether we are in scientific research, product development, production management, technical trade and technology import or enter into joint ventures with foreign businessmen, we cannot help but run into it. An engineering or technical worker who has no or little understanding of patenting will feel quite helpless when a problem arises and may even be taken advantage of without knowing it.

In our age, science and technology has developed to such an extent that it is now challenging the universe and academic disciplines overlap and interact with one another to a high degree. Technical personnel involved in applied science must go about the selection of research topics with a strategic mind and a long-term view. In other words, they must either break fresh ground or improve upon existing technology to make new inventions. To avoid duplication or wasted effort, we must begin by sieving through domestic and foreign technical literature, paying particular attention to patent literature because as far as applied science is concerned, no other literature equals patent literature when it comes to breadth of coverage and the timeliness of its information. If we ignore patent literature, we will suffer economically and miss many an opportunity. For example, there was this thermos factory which came up with a process replacing silver plating with magnesium after years of hard work only to find that a British company had taken out a patent in Britain on the same process as early as 1929. This lesson must always be borne in mind. Right now our engineering and technical personnel are confronted with a host of important and urgent issues, such as formulating a scientific research strategy, protecting inventions and building on others' technical achievements to make new inventions. If we are to do well in these areas, we must familiarize ourselves with patenting and make a special effort to learn and make use of patent literature.

Since a patent is the fruit of an inventor's creative mental labor, the number of patents held by an individual or unit is an important indicator of his or its technical might. The world-famous Bell Laboratories in the United States,

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for instance, prides itself on the fact that it takes out a patent every day on the average. From now on, we in China must also take patents into consideration when it comes to inter-factory cooperation, university-factory cooperation, or setting up a joint venture with a foreign company.

China's patent law gives everybody an equal opportunity to apply for a patent, an opportunity available to us all. Indeed, many patented inventions overseas are held by children and elderly people. There are three kinds of patent in China, for inventions, practicality and novelty, and exterior design. In terms of innovativeness, we demand less of a process or object to be patented on account of its practicality than of an invention. Examination and approval procedures governing the former are also simpler. For these reasons, one should not be intimidated by the idea of applying for a patent; it often happens that a person has invented something without even knowing it. In contrast, the individual who is acquainted with patenting is in a stronger position to consciously come up with more inventions because he understands the conditions of invention and the criteria for the granting of a patent. An inventor who fails to seek prompt legal protection runs the risk of having one of his competitors stealing his idea and patenting it. In a tragic twist of events, the inventor may become the violator of another person's patented right. All this shows that that whether or not a technical person has a patent knowledge makes a good deal of difference.

As China's open door policy develops in depth, cooperation between Chinese factories and their foreign counterparts, the import of advanced foreign technology and the export of Chinese technology will all increase, making it all the more unavoidable that we will run into patent issues. Without a patent knowledge, we will put ourselves in a weak position and may even be taken advantage of, as when we pay a hefty sum for a piece of outdated patented technology from abroad or when we sell off in the routine way a new process which should be patented. Hence engineering and technical staff must equip themselves with patent knowledge. Otherwise not only will their work suffer, but they may also fall behind in the competition.

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CSO: 4008/2034

NATIONAL DEVELOPMENTS

DEVELOPMENT OF POWER COMMUNICATIONS NETWORKS DISCUSSED

Shanghai XIANDAI TONGXIN [COMMUNICATIONS TODAY] in Chinese No 6, 8 Jun 85 pp 161-162

[Article by Peng Chunshao [1756 3196 4801]: "Step Up the Development of Power Communications Networks"]

[Text] Electric power communications are principally to serve power system dispatching and management. Along with the increasing complexity in the development and operation technology of modern electric power systems, a continuing series of new requirements have been brought forth with respect to the automation of communications, remote dynamics, and dispatching, while progress in modern communications and automation technology has created conditions for the operation of electric power systems to develop to even higher levels.

An integral entity for the generating, supplying, and utilizing of electric power comprising two or more electric power plants, transformer stations, transmission lines, power distribution grids, and subscribers is termed an electric power system. Complex electric power systems use connecting lines to join together the power grids of several regions for centralized dispatching and mutual support, raising the reliability and economy of the power supply. The nations of the world have all developed in this direction for many years. Currently in the United States, Japan, Western European nations, and other nations, the capacity of some large systems is as high as 30 to 70 million kW. The capacity of combined power grids in the European part of the Soviet Union is as high as 120 million kW. Of our country's six interprovincial power grids, the capacities of the North China, Northeast, East China, and Central China systems are all approaching 10 million kW, and it is planned that they will grow to 20 million kW by 1990. It is expected that, when the giant Changjiang Gorges hydroelectric station is introduced in the year 2000, the seven large electric power grids in existence at that time will have a total capacity of more than 200 million kW when joined together. Therefore, from the viewpoint of space alone, if there is not a corresponding communications network to accompany such a gigantic system to fulfill the dispatching requirements of all levels, there will be no way to operate the electric power system.

Because the production, transmission, distribution, and consumption of electrical energy is continuous and it cannot be stored, electric generating capacity must be on the basis of subscriber requirements with consumption determining production and calculated accurately to the utilization hour. If we look at the load curves on the computer screen in an electric power dispatch office, we would find that there are highs and lows during the 24 hours in a day, with peaks generally at night, dropping to valleys during the latter half of the night. Winter and summer as well as regular days and holidays are different. The starting and stopping of large industrial and mining machinery as well as the operation of electric trains can cause load fluctuations. With a sudden change in the weather, large modern cities can become brilliantly illuminated in broad daylight; severe cold, intense heat, or a wonderful television program, leading to the turning on of millions of air conditioners and television sets can also cause the load to rise. These all require the dispatch office to adjust generator output at any time to maintain the balance between supply and demand. What would be the consequences of imbalance? If power generated exceeds the load (includes active and reactive), periodic wave voltage will rise and conversely periodic wave voltage will drop. High voltage will burn out many light bulbs, and low voltage will burn out many motors, low periodic waves can cause reduced industrial production, particularly affecting the quality of textiles and paper. Low periodic waves can also lead to turbine blade breakage which can cause a destructive accident endangering the electric power system itself. Therefore, the dispatch office must continuously gather the large quantity of data transmitted by telemetry, monitoring generator output, current on lines, transformer load, and periodic waves, as well as water levels, the atmosphere and rain. It must also direct by telephone the starting or stopping of generator groups, automatically adjust with computers generator output to adapt to load changes, so that periodic wave voltage will remain stable within prescribed tolerances, keeping the quality of the electrical energy at a passing level.

An electric power system is a production system of tremendous complexity, with the area to which it supplies power encompassing tens and hundreds of thousands or even more than a million square kilometers, with rapid electromagnetic changes; trouble in a single link not properly handled can expand to ripple throughout the system, leading to power outages over a large area. A major power outage can have a serious effect on the government, the economy, national defense and the people's daily lives. For example, a one-minute power outage in broadcasting would have a worldwide political effect. A 15-minute power outage in an aluminum plant would cause electrolysis of aluminum troughs, making them worthless. A 30-minute power outage in a steel plant would result in the solidifying of the liquid steel in the high-temperature furnaces. A power outage in the case of ventilators and water pumps used in mines and wells would pose a serious threat to the mining workers' lives. Further it goes without saying that a power or water supply failure in a large city would have a major effect on thousands of families and tens of thousands of households. It is estimated abroad that losses in a major power failure would be 30-60 times the cost of the power.

To prevent troubles in an electric power grid, various protective arrangements must be relied upon, with the most sensitive current high-frequency protection

relying on communications to transmit information, with an activation time of 10-20 milliseconds. Should activation be slowed, in error, or prevented on account of interference or communications problems, it could lead to an expansion of the accident. Whenever an accident brings about an abnormality in system operation, dispatch personnel and the generating plant and transformer stations concerned must be closely coordinated and deal with the problem in an orderly fashion under unified direction to reduce losses from the accident to a minimum and to ensure that uninterrupted power is supplied to the customers.

Although it would appear that large power grids have a great "wind hazard," if we only have modern communications and automated methods which are well-managed, they can bring great economic benefits. On the basis of projections to the year 2000, one-third of our country's coal and one-tenth of our oil will be used for power generation. If hydroelectric power is utilized sufficiently, if more high-efficiency coal-saving large generators are activated, if advantage is taken of the daylight and time differentials throughout our vast land to stagger peak loads and dispatch [power] rationally, we could save large quantities of fuel.

From this it may be seen that dispatching and management of a modern electric power system is a very complex task for which dispatching must be well-organized, and which must have an automated monitoring and control system comprised of computers, operating arrangments, and a data network before safe and economic operation of the electric power system may be assured. Further, with the above being realized in an area encompassing hundreds and thousands of [square] kilometers, we must depend upon the support of a complete and reliable communications network.

According to information from the International Conference on Large Power Grids, there are currently 146 principal large electric power networks worldwide utilizing computerized dispatching, with the number being even greater if subsystems are included as well. In the United States 90 percent of the 3,000 power companies use computerized dispatching, while Britain, France, and Japan are all modifying and modernizing their entire power grids through computerization. Major developments in electric power communications are taking place simultaneously in various countries. Statistics gathered in 30 nations on dispatch telephone, remote activation, and protection channels indicated totals of 152,173 in 1972, increasing to 294,364 in 1980 -- almost a 100 percent increase in 8 years. As a result of the development of automated dispatching, a change has occurred in the proportions of various types of communications channels and varieties of communications media.

Remote activation channels increased sharply to 175,216 in 1980, representing 59.5 percent of the total of the three types of channels.

High-quality microwave and very-high-frequency multiplex communication channels increased abruptly by 37 percent, rising from 12 percent of total communication channels in 1972 to 19 percent in 1976. Electric power carrier maintained a level and stable 12 percent. On the other hand, the proportion of leased public telecommunication lines decreased steadily from 6 percent in 1972 to 4 percent in 1976.

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It is worth noting that there was a major development in mobile radio stations with nearly 100 percent growth from 49,568 stations in 1972 to 94,299 stations in 1980.

Since liberation, there have been major developments in our country's electric power communications, which now have 180,000 circuit miles of electric power carrier channels and 23 microwave channels approximating over 6,000 kilometers forming the beginning of a three-level dedicated communications network using as centers the major power grid dispatch offices, provincial dispatch offices, and prefectural dispatch offices. Above provincial dispatch offices there are a total of 369 remote activation installations. The three major electric power grids --North China, Northeast, and East China -- have successively utilized computers of Chinese manufacture to realize preliminary safety monitoring. In 1981 two dispatching computer systems with a relatively complete repertoire of functions were imported from the United States and Japan and installed in Beijing and Wuhan along with a 480-channel PCM digital microwave line. The circuits cross three provinces and one municipality, interconnecting along the way with the dispatch center of the Ministry of Water Resources and Electric Power; the Central China and North China grid dispatch offices; the Hubei, Henan, and Hebei provincial dispatch offices; as well as their subordinate regional dispatch offices and important plants and stations; plus serving the generation, dispatching, and provision [activities] of water resources and flood prevention along the Yellow River and Yangtze River, laying the initial foundation for the construction of primary and branch microwave lines henceforth. Compared with advanced nations and with the speed of development of our country's electric power grids, however, there is still a considerable gap. This can be seen by comparing the number of microwave voice circuit kilometers per 10,000 kilowatts of installed generator capacity. For example it is 450 for the United States Bonneville system, 160 for Japan's Northeastern Power Company, and 102 for the Tokyo Power Company, while it is only 10.1 for our northeastern electric power grid, 13.2 for the North China electric power grid, and 9.8 for the East China electric power grid. To sum up, whether from the standpoint of quantity or quality, the current channels are far from fulfilling the requirements of the electric power system.

Along with further development of electric power networks, our country's electric power network dispatching organization will cross over from three-level dispatching to four-level dispatching, that is with a single combined national dispatcher, seven regional network dispatchers, 23 provincial dispatchers and 200 to 300 local dispatchers. In 1990, to ensure that the electric power system operates safely and economically, seven network dispatchers and a portion of the large provincial dispatchers will have their dispatch control automated; in the year 2000 the various major power generation networks in the Changjiang Gorges will be interconnected; and, along with the requirement for restructuring enterprises and modernizing electric power network control, it will be essential that a computerized layered large system be brought into being in our country. To achieve this step, the construction and modification of the dedicated electric power communications network must be expedited.

How can the steps in constructing electric power communications be expedited?

First, there must be unified recognition, overall planning, and expedited development of a digital microwave backbone network.

Because electric power networks develop from small to large, increasing in size with each interconnection, once a dispatcher is upgraded, long-distance communications become the dominant problem. For a long time there has been debate over whether to build a dedicated communication network ourselves or which form of communication to adopt in organizating a network, and considerable time has been lost over it. Looking back at the early years of liberation when we acted according to foreign experience, other than the development of electric power carrier, A demand of electric power communications was that a communication line for maintenance and repair be constructed along every high-voltage [transmission] line. Not long after that in the mid-1950's, however, because of our country's lack of timber resources, such construction ceased, leading to a long period during which urgent dispatch communications were maintained by only a small number of electric power carrier lines. There was no solution to the administrative and service communications prescribed by the technical regulations of the electric power industry. In the 1960's microwave relay communications were first adopted for the Northeast network. Although microwave was the solution for the various communications requirements of the electric power system by virtue of its high channel capacity and high communication quality, its greatest benefit was that it did not rely upon power transmission lines, so that in electricity generating plants and high-voltage transformer stations it would not be subject to interference from powerful electric fields nor the dangerous effects of high electric potential stemming from large electric currents being grounded, making it both comparatively reliable and with strong resistance to catastrophes, resulting in its use in more and more countries. For example in the United States its use began in the 1950's, and by 1972 power companies in the United States had installed an aggregate 210,000 kilometers of microwave circuits. In recent years our country has also installed some short-distance 120-channel digital microwave, but they cannot meet requirements objectives for use in power grid backbone communications. The over 2 years' operating experience of the Jinghan digital microwave system proves that digital microwave has good jamming resistance, has strong security, is convenient for the transmission of data, and channels may be dropped easily along the route, whose advantages fit the requirements of an electric power system very well.

Second, we must innovate and exploit latent capabilities, and continue to develop frequency resources in the electric power system.

Since the invention of power [line] carrier [systems] in 1921, they have stood the test of time and retained an exuberant vitality. On the basis of projections, in the year 2000 our country will have 160,000 kilometers of superhigh-voltage lines of over 220,000 volts, 650,000 kilometers of medium-voltage lines from under 110,000 volts to 30,000 to 50,000 volts, and even more low-voltage lines of under 10,000 volts. There is no basis for considering that this technological area has no further developmental future. The tasks which electric power carrier can perform fall into the following principal areas:

1. Introducing technology, modernizing production, raising the quality and quantity of products, and, based on common international standards, prescribing standards and serial type listings of electric power carrier and coupling equipment to fulfill the requirements of telephone, remote activation, and protection of multifunction transmission.

2. Replacing high-energy-consumption electron tube equipment, and adding direct-current power supply systems to ensure that accidents do not interrupt communications, and do not lose data.

3. Cooperating with strong electric power departments to develop insulated lightning protection lines and diverse-conductor multichannel communication has a certain technical and economic value, but they are not appropriate for use in areas of heavy lighning activity or severe ice storms.

4. To break through departmental boundaries and open agricultural village power networks to serve common-user communications on condition that agricultural electric power dispatch communications are preserved.

Third, the application of fiber optic communication in the electric power system must be emphasized.

Because optical fibers are themselves a medium, and are not subject to the effects of lightning, inductance, vibration, electromagnetic interference, they have a future of broad application in electric power systems. The nine major power corporations in Japan currently have 180 optical fiber systems in operation with a combined length as great as 1,000 kilometers. The 25 power corporations in the United States have 38 optical fiber systems. In the United Kingdom on a 400,000-volt line 21 kilometers long, 480 channels of PCM communication have been multiplexed on a optical fiber cable utilizing an aerial ground line, interconnecting all communications and automation channels between the central power generating station and the southwest substation. We should pay sufficient attention to this trend.

Current large electric power enterprises generally have the characteristic of integrated computer and communications networks comprising the energy management system and information management system for modernization. For example the French power corporation has established three centers: An energy management center controlling in levels eight regional dispatchers and 100 local dispatchers. A scientific computation center connected with 512 terminals to organize the dispatchers' daily, weekly, monthly, annual and up to 2-to-5-year midrange plans. An information management system utilizing a total of 20 large and medium-sized computers, 791 terminals, and a data network covering the whole country which also joins the three centers together, so that all officials of the French power corporation may retrieve required information through the terminals. In the processing of electricity bills alone, receipt of payment a day early could earn 3,000,000 franks in interest.

Our country is a developing socialist nation positioned in the current age of information revolution represented by microcomputers, fiber optics, and satellite communication. In preparations to build the power communication

network, we should start with our country's current situation, adopt widely the positive features from all nations while strengthening cooperative efforts among fellow-departments, suiting measures to local conditions, utilizing all modes of communication in integrated fashion, crossing over step-by-step, making strong efforts to build the power communication network into the digital communication network for modernization, to push our country's electric power dispatch control and enterprise management modernization to an even higher level.

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CSO 4008/1058

NATIONAL DEVELOPMENTS

SCIENTIFIC, TECHNICAL SYSTEM RESTRUCTURED IN HEBEI

Tianjin JISHU SHICHANG BAO [TECHNOLOGY MARKET WEEKLY] in Chinese 13 Aug 85 p 1

[Text] Following its scientific and technical work conference, Hebei has promptly studied the new situation, reviewed its latest experience, tackled new problems and taken effective measures to restructure the scientific and technical system aggressively.

Cadres have been organized and sent to the grassroots to conduct in-depth studies, sum up experience and provide concrete guidance. In June, the Hebei CPC Committee set up 6 fact-finding groups made up of 4 members from the leading party group, 9 bureau or office chiefs and 18 cadres and dispatched them to Handan, the Hengshui area and Zhengding County to make surveys revolving around the four topics: scientific research organizations, microcomputer applications, medicine and sanitation and the management of scientific and technical achievements. The fact-finding groups inspected a total of over 60 enterprises, 3 counties, 12 villages and 11 research institutes; convened more than 40 informal discussions of various types; and held discussions with relevant leading comrades from prefectures, municipalities and counties, at which they pointed out the direction and focus of the drive to restructure the scientific and technical system in cities and rural areas. As far as cities are concerned, the main goal of restructuring should be to increase the adaptability and economic results of enterprises. It should focus on enhancing the ability of an enterprise to absorb and develop technology around which other things revolve. In rural areas, restructuring should aim at changing the agricultural economic structure; advancing the agricultural economy in the direction of specialization, commercialization and modernization; bringing together technology, the development of skilled personnel, the technical market and information; and welding them into an organic, coordinated entity. Now that the appropriation system for research institutes has been reformed, the agencies in charge at various levels should simplify administration, delegate power and give more autonomy to research institutes. Externally, a research institute should adopt a technical contracting system; internally, individuals should be held responsible for an entire project. In the process, the practice of "eating out of the common pot" will wither away and the initiative of the institute and its personnel fully unleashed.

On the basis of the above work, the province has developed a fairly firm grasp of the situation. The Hebei Science and Technology Commission has published 18 bulletins on the reform situation and experience since last July, providing useful general guidance. It has also taken care to relate the experience of selected units to the whole province, using and popularizing the example of the Hengshui area and Handan to promote work throughout Hebei. In addition, they have selected certain topics for further detailed research, including the expansion of institute autonomy; the institute director responsibility system; the social orientation of enterprises; the present state and management of private technical development and service organizations; the experience of the technical market in serving the needs of small, medium-sized, rural and township enterprises and future policies; the number, distribution and utilization of self-educated personnel in those enterprises and in villages; and the strengthening of enterprises' capacity to absorb and develop technology. As a result of their detailed work, they have been able to put forward solutions to all these issues, thus powerfully boosting the restructuring effort.

NATIONAL DEVELOPMENTS

SURVEY OF SHANGHAI'S MIDDLE-AGED S&T PERSONNEL

Beijing RENMIN RIBAO [OVERSEAS EDITION] in Chinese 9 Sep 85 p 4

[Text] Respect for knowledge and skilled personnel is taking hold and scientific and technical [S&T] personnel are making their presence felt more strongly than before, according to a survey on 3,714 middle-aged scientific and technical workers in Shanghai conducted by the municipal government's Office of Scientific and Technical Cadres. However, intellectuals, particularly middle-aged intellectuals, are still confronted with many problems in their work and daily life, which we must solve conscientiously in order to further tap the potential of this vital force.

Of the scientific and technical personnel surveyed, 7.4 percent held senior technical positions, 69.5 percent held middle-level technical positions and 23.1 percent held junior technical positions. In response to a question in the survey, 25.8 percent said their jobs made good use of their expertise, 67.2 percent said their jobs made basic use of their skills, and 7 percent said their jobs failed to make use of their skills. If we compare the results of this survey with those of a 1983 study by the Shanghai Science and Technology Association on more than 5,000 scientific and technical workers, there has been a 4.8 percent increase in the number of respondents who said that their jobs made use of their expertise and a drop of 8 percent in the number of respondents who said otherwise. The latest survey also reveals that 1,892 people, or more than 50 percent, have taken up a variety of leadership responsibilities and 1,092 have won national science awards and invention prizes, a sign of the active role played by middle-aged scientific and technical personnel in science and technology.

A number of problems affect their efforts to make further contributions. First, limited opportunities to update their skills and keep up with the latest developments in their fields. The survey shows that as many as 2,800, or 77.1 percent, "have not taken a refresher course" in recent years. An analysis of the opportunities for advanced training for people at different technical levels and in different age groups shows that the older he is and the more senior his position, the less is the expert likely to have an opportunity to engage in advanced training. Second, a serious discrepancy between job titles and the professional standards of the incumbents. Two years after the imposition of a "freeze" on technical job title evaluation, scientific and technical personnel are demanding a "thaw." In the latest

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survey, 20.1 percent of all respondents indicated a job title-related problem. An analysis of the work of 1,614 workers with middle-level job titles shows that 164 were already discharging responsibilities more appropriate to senior personnel. At the same time, 290 out of 499 workers with junior job titles were doing the work of middle-level personnel. Third, housing shortage, low wages and declining health. As a result of greater government efforts in recent years, the income of intellectuals has increased and housing shortage among the scientific and technical personnel of certain units has eased somewhat. On the whole, however, these problems remain fairly serious. In response to the question, "what is your biggest personal concern," 1,231 people answered overcrowded housing. Of the total population surveyed, 46.8 percent lived in a single room. In terms of footage per person, as many as 25.1 percent lived in less than 4 sq m. Fourth, middle-aged scientific and technical personnel promoted to leadership and managerial positions often find they lack the power to carry out their responsibilities. Of 483 people questioned about this situation, 26.1 percent said they did not have the power necessary to discharge their duties.

NATIONAL DEVELOPMENTS

ZHEJIANG GOVERNOR ON RESTRUCTURING S&T SYSTEM

Hangzhou ZHEJIANG RIBAO in Chinese 27 Aug 85 p 1

[Text] Addressing the closing session of the provincial scientific and technical [S&T] work conference yesterday, Xue Ju [5641 7467], deputy secretary of the Zhejiang Provincial CPC Committee and governor of the province, pointed out, "Scientific workers and economic workers must share a common goal. They must synchronize their steps and act in unison to vitalize Zhejiang's economy. Economic work and scientific work must achieve a high degree of interdependency and integration. And the key to all this lies with party and government leadership."

In his speech entitled "Firmly and Systematically Reform the Scientific and Technical System To Better Serve Zhejiang's Economic Vitalization," Comrade Xue Ju said, "As far as restructuring the scientific and technical system is concerned, many problems remain to be solved, but they essentially boil down to further integrating science and technology, on the one hand, with economic development, on the other. By 'further,' I mean that apart from questions of understanding and principle, we must also tackle issues relating to the system and personnel. We must fully mobilize the enthusiasm of the masses of scientific and technical workers so that they will come up with more and better achievements faster and convert them into productive forces. This way social and economic developments will be promoted."

Comrade Xue Ju cited a wealth of facts to show that Zhejiang's masses of cadres and scientific and technical workers over the past few years have steadily enhanced their consciousness of the strategic principle, "economic development must rely on science and technology, while science and technology must be oriented toward economic development," and scored outstanding achievements in advancing science and technology and promoting economic development. "The fact that our provincial economy has enjoyed sustained and rapid growth has much to do with science and technology. Many scientific and technical comrades have made substantial and practical contributions and the situation is developing in an encouraging way. However, we must open our eyes to the fact that our economy remains relatively backward and our science and technology are trailing those of advanced nations. At a time when a new high-tech revolution is sweeping the world, we face serious challenges. If we do not strive to develop science and technology, our existing advantages in natural resources, manpower and traditional handicrafts, etc., will be eroded

more and more, while our weaknesses such as technical backwardness, lack of information and inefficiency will only worsen over time. If this comes to pass, not only will we fail to narrow the gap between us and developed nations, but we may actually widen it. We should also see that the restructuring of the scientific and technical system is still a fledgling enterprise and that the integration of science and technology with the economy has not been fully accomplished. How to mobilize the initiative of the masses and turn them into "achievers," how to create the ideal environment to bring out the best in outstanding young experts and enable them to excel; how to integrate science and technology and the economy even more closely so that scientific achievements can be converted into productive forces without delay--all these issues are major problems confronting party and government leaders. Their solution requires that we further study the Central Committee's 'Resolution,' unify our understanding and experiment continuously."

Comrade Xue Ju pointed out, "To succeed in restructuring the scientific system, we must zero in on two tasks. First, we must gradually reform the operational mechanisms of the scientific and technical system. By reforming the appropriations procedure and opening up the scientific and technical market, we should enable scientific and technical organizations to develop on their own and help them consciously serve economic construction and social development. Second, we must gradually reform the organizational setup to give impetus to scientific research institutes, colleges and universities and production enterprises to establish all kinds of linkages with one another, thereby expediting the conversion of scientific achievements into productive forces and substantially enhancing the technical developmental capability of enterprises. Once we come to grips with these two tasks, we will be able to mobilize the masses of workers to excel themselves."

Comrade Xue Ju stressed that to ensure the success of scientific and technical reform, we must insist that equal attention be paid to socialist spiritual civilization and material civilization. He said, "Science and technology are an important component of the construction of the socialist spiritual civilization as well as of the material civilization. They are the precursor and rear base of economic development. A socialist society with a commodity economy must fully recognize and evaluate the values created by mental labor, respect the law of value and acknowledge that the overwhelming majority of scientific and technical achievements are commodities. Otherwise, scientific research and production cannot be integrated to share a common economic fate. On the other hand, scientific and technical commodities do differ in some ways from other material commodities. The latter's modes of exchange are obvious. The former may create very high values, but they are also fraught with risks. Hence we cannot apply to them the conventional commodity exchange principles, which explains why scientific research units and workers must understand that their main mission is to serve economic construction and the people. They must not "put money above all else," engage in illegal activities or pursue personal or special interests in the name of providing technology. Since much of what we do as reformers is exploratory, it is inevitable that all kinds of problems crop up in the course of reform, including errors and mistakes. But making mistakes fundamentally differs from engaging in illegal activities in one guise or another. Our position is that we must persevere with reform even

as we firmly crack down on the unhealthy trends. As we go about stamping out the latter, we must take care to differentiate between different things. We must strictly deal with what is clearly an unhealthy trend such as stealing another person's scientific research achievements, revealing state secrets, pursuing special interests, going into business in partnership with a number of people and using public scientific research funds and equipment to make money, etc. Whatever falls within a grey area must be analyzed in detail and handled carefully in accordance with the eight delimiting factors set forth in the circular issued by the State Science and Technology Commission. For our purpose, two are of particular importance: 1) awards must be given out in accordance with the reform pilot project plan, but not beyond and above what the plan specifies. There must be no random issuance of bonuses or material goods however they are disguised. Second, assuming that they have fulfilled their regular duties, scientific and technical personnel are permitted to undertake scientific research and offer consulting services in their spare time and receive reasonable remuneration for such services, which cannot be regarded as illegitimate income. But spare-time work must neither infringe upon the technical rights of their units nor affect their regular on-the-job performance. Leaders at various levels must take pains to preserve the enthusiasm for restructuring the scientific and technical system, make the best use of the situation and overcome the weaknesses, while maintaining whatever existing advantages. Scientific and technical personnel should emphasize scientific ethics and contribute to socialist modernization wholeheartedly."

Discussing the strategic mission of scientific and technical development, Comrade Xue Ju said, "The development of science and technology must take Zhejiang's actual circumstances as its point of departure, bring out the province's characteristics and give full play to its strengths. For example, given our highly diversified agriculture and fairly advanced commodity economy, isn't there much scientific and technical work can do to develop Zhejiang's famous native products and the processing of its agricultural by-products? The bulk of Zhejiang's enterprises are small concerns making articles of daily use. Can we not make better use of the kind of advanced technology which is low-cost, has a short turnover period and produces quick results to transform these enterprises to speed them up on the road toward modernization? How can we make use of our fine harbors and five opened cities to accelerate the attraction of foreign capital and technology and cooperation with domestic enterprises? How can we speed up the technical modernization of our enterprises, particularly those which are supposed to earn foreign exchange? Zhejiang abounds with natural resources in the mountains and the ocean. Can science and technology play a greater role in developing them? Zhejiang's weaknesses are its lack of energy and raw materials and its transportation bottlenecks. Can science and technology be relied on to come up with new energy and raw materials, help us cut down on energy and material consumption and improve the transportation situation? Such are the challenges posed by economic construction to scientific and technical work. Our scientific and technical workers should devote themselves to those priority projects which impact the development of the overall economy and put their wits to work in making further contributions to the four modernizations. In drawing up their plans, importing technology and carrying out technical modernization, economic agencies should take the initiative to invite relevant

scientific and technical personnel to take part, involve them in feasibility studies and coordinate their actions in order to strengthen cooperation."

Comrade Xue Ju finally emphasized, "One of our leaders' most important duties is to bring out the best in the skilled personnel we already have and develop an army of new talented individuals. More than anything else, skilled individuals hold the key to the success of the restructuring of the scientific and technical system and the vitalization of Zhejiang's economy. In demanding that party committees and governments at all levels strengthen their leadership over science, technology and education, we are not saying that responsible comrades in the party and government should promote science and technology indiscriminately, without any order of priorities. Their primary responsibilities are to develop an eye for skilled people, unite them and give them proper assignments, while enabling the existing personnel to give the best they can. It is also the leaders' responsibilities to create an environment where middle-aged and young skilled personnel can really come into their own and to turn out an army of new qualified individuals. In evaluating a skilled individual, we should focus on his qualifications, morality, expertise and actual contributions to the four modernizations. Senior personnel aside, we must also pay attention to junior and middle-level personnel. We must seek out the unknown diligent doer as well as the famous. Many responsible comrades in the party and government at the municipal, county, district and township levels today care about their skilled personnel and hardworking intellectuals at the forefront, support their work, interest themselves in their livelihood and earnestly help them solve their practical problems. This solicitous spirit is much more powerful than money. As some comrades say, 'To keep people, you must win their hearts, and what wins the hearts is sincerity.' The 'way to make proper use of personnel' is to boldly promote talented individuals and place them in jobs which match their expertise. The 'way to pool talent' is to organize scientific and technical workers and other qualified people and launch scientific and technical activities, including technical consulting. The 'way to train skilled personnel' is to strengthen education and develop all kinds of experts. I believe all of this should be carried out as extensively as possible. How to create an environment where a young or middle-aged skilled worker can flourish is also an essential issue facing us today. A scientific and technical achievement demonstrates the value of a skilled individual as well as that of a commodity. An expert or a talented person can revive an enterprise and even vitalize an entire trade. This is what makes skilled personnel give their best. In evaluating the achievements and performance of a scientific research unit or enterprise, we must also evaluate its people. Workers with an outstanding record, particularly young and middle-aged people, should be promoted to important posts. Those who have made exceptional contributions should be handsomely rewarded. Party and government leaders at all levels should regard the training and deployment of qualified personnel one of their priorities and give it constant attention. If they manage to do this, they will have fulfilled their responsibilities as leaders. We should also make this an important part of our evaluation of leading cadres."

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CSO: 4008/2033

NATIONAL DEVELOPMENTS

GUANGXI'S SYSTEM FOR APPRAISING S&T ACHIEVEMENTS

Tianjin JISHU SHICHANG BAO [TECHNOLOGY MARKET WEEKLY] in Chinese 27 Aug 85 p 1

[Article by Cheng Wen [2052 2429]: "Guangxi Announces New Measures To Appraise Scientific and Technical Achievements"]

[Text] To meet the needs of scientific and technical [S&T] developments, the Science and Technology Commission of the Guangxi Zhuang Autonomous Region people's government recently formulated the "Provisional Measures of the Guangxi Zhuang Autonomous Region for the Appraisal of Scientific and Technical Research Achievements." Drawn up in accordance with the scientific reform spirit of the CPC Central Committee and based on problems now existing in the appraisal of scientific achievements in the region, the measures have been well received by the scientific community.

The new regulations note that the appraisal of scientific and technical achievements is an important link in the management of science and technology. It ensures the quality of scientific results and constitutes a vital step in the commercialization of research results through production. Any achievements which have not been appraised or which have been determined to be not in compliance with specified requirements will all be ineligible for registration or receiving prizes.

Under the new regulations, appraisal will take place at three levels: 1) projects designated as priority projects in the region's scientific and technical plan will be appraised by the regional Science and Technology Commission. The same applies to projects whose appraisal has been entrusted to the regional Science and Technology Commission by the State Science and Technology Commission or other relevant central ministries or commissions; 2) projects designated as priority projects in the scientific and technical plans of a particular office or bureau directly under the regional government or of a particular municipality or prefecture should be appraised by the bureau or office concerned or by the science and technology commission of the prefecture or municipality concerned. The same applies to projects whose evaluation has been entrusted to any one of these agencies by the regional Science and Technology Commission; and 3) projects undertaken by enterprises, institutions, counties, districts or individuals or between grassroots units are to be appraised by the county science and technology commission or grassroots units at a rank above the county. If the project in question is

particularly important or covers a wide area, an application may be made to the next higher authorities or higher science and technology commission for appraisal.

The method of appraisal will vary depending on the type and substance of the achievements concerned. Gone was our traditional exclusive reliance on the appraisal meeting, which was wasteful in terms of manpower, material and financial resources and failed to take efficiency into account. Appraisal by correspondence should be used where scientific papers, technical reports or technical data suffice as a basis for evaluation, where field inspection and material testing are not needed and where a specialized agency has already put out a technical report on the achievement. Appraisal by correspondence is conducted by a panel comprising about 15 specialized technical individuals (of whom four fifths or more should hold at least middle-level positions) put together by the agency responsible for appraisal. Where appraisal must involve a combination of field inspection, material testing and collective discussion, the agency concerned should convene an appraisal meeting to be made up of no more than 15 people, of whom at least four fifths, or 7, should be professionals in middle level positions or higher. The meeting in most cases must not last more than 3 days.

An applied scientific and technical achievement will be deemed to have passed the appraisal test if any one of the following applies: 1) the agency which commissions the project formally checks and accepts it and issues a certificate of quality in accordance with the research and development agreement or contract; 2) specialized agencies in charge of technical management (eg., standards, weights and measures, testing, medical testing and varieties) test an achievement, determine that it is up to par and so certify; and 3) a project which has demonstrated its technical maturity and economic viability in production or practice will be submitted to the agency concerned for testing and approval. A certificate of quality will be issued.

In general, theoretical scientific research achievements will be appraised one year after their formal publication.

The appraisal measures also provide for the rights and obligations of people engaged in the evaluation process. For example, they have the right to express their opinions about the achievement under review and can veto a decision. They can address inquiries to the person responsible for the project about the state of his research. On the other hand, it is their duty to make a realistic appraisal of the achievement in question. Appraisers will be paid a technical consulting fee by the unit which applies for evaluation in accordance with relevant regulations. Other than this payment, no gifts or souvenirs will be allowed.

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CSO: 4008/2033

NATIONAL DEVELOPMENTS

DEVELOPMENT OF CHINA'S CHEMICAL FERTILIZERS EXAMINED

Beijing XUAXUE TONGBAO [CHEMISTRY] in Chinese No 10, 18 Oct 84 pp 12-13, 5

[Article by Lu Rukun [7626 1172 0981], Nanjing Institute of Soil, Chinese Academy of Sciences]

[Text] The development of chemical fertilizers in China since 1949 has been rapid with an average growth rate of 26.2 percent each year. Its production in 1982 reached 12.76 million tons, which is more than a thousand times that of 6,000 tons produced in 1949. China's fertilizer production was rated the third in the world way back in the 70s. It was quite a success. However, due to various reasons, there are still some problems which need to be solved during this development period.

I. The Scale of Development

Total supply of chemical fertilizers just meets the present need, but what will the requirement be in the year 2000 when agricultural products reach 960 billion jin [1 jin=½kg]. Based on the status of China's soil nutrients, crop fertilizing needs, general utilization rates of chemical fertilizers and probable sources for organic fertilizers, the amount will be roughly estimated*:

21 million tons of N, 13 million tons of P_2O_5, and 5 million tons of K_2O.

Based on estimates from departments concerned, we predict that in 2000, the production of chemical fertilizer per year will probably be: 21.3 million tons of N, 5.09 million tons of P_2O_5, and 1.36 million tons of K_2O. Another estimate is: N 15 to 16 million tons of N, 7 million tons of P_2O_5 and 1.5 million tons of K_2O.

From the above figures, we conclude that in the year 2000, we may have enough N fertilizer, but P fertilizer will satisfy only 40 to 50 percent, and K fertilizer only around 25 percent of our needs.

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*Estimation method used is by and large based on this author's paper published in HUAFEI GONGYEH [CHEMICAL FERTILIZER INDUSTRY], No 5, 1979 pp 63-66

II. Problems Regarding the proportion of N, P, and K Fertilizers

The problems of low proportion of the production of P and K fertilizers have existed for a long time. For instance, the production of P fertilizer decreased to less than one-third from 1969 to 1979, and the production of K fertilizer was almost nil. (see Table 1)

Table 1. Proportion of N, P and K fertilizers 1969-1979

Proportion	1969	1971	1973	1975	1977	1979
N	1	1	1	1	1	1
P_2O_5	0.71	0.57	0.53	0.41	0.31	0.20
K_2O	0.002	0.007	0.003	0.002	0.004	0.002

Globally, the production of N fertilizer was always higher than that of P or K fertilizer. This is because the use of N fertilizer showed better results and the development of P and K fertilizers was suppressed due to the limited natural sources in some countries. In fact, the storage of P and K in the world is high (P, 144 billion tons and K (K_2O), 35.5 billion tons as estimated by the United Nations). But the problem is that the mines are distributed in only a few countries. Hence, the proportion of the production of P and K fertilizers was low in some developing countries (see Table 2).

Table 2. Ratios of N, P and K fertilizer in some areas

	(let N=1)	
Area	1977-1978	1980-1981
World	1 = 0.57 = 0.46	1 = 0.52 = 0.40
North America	1 = 0.53 = 0.54	1 = 0.48 = 0.52
Western Europe	1 = 0.64 = 0.59	1 = 0.57 = 0.54
USSR and East Europe	1 = 0.70 = 0.73	1 = 0.67 = 0.63
Developing Countries	1 = 0.40 = 0.16	1 = 0.38 = 0.16
Developed Countries	1 = 0.67 = 0.64	1 = 0.62 = 0.57

The overall tendency shown in [Table 2] is as follows:

The total production of P and K fertilizers was about equal to that of N fertilizer production in developing countries. Of course, each country has different needs regarding the ratio of N, P and K fertilizers. The estimate of China's needs in 2000 is: 1: 0.6: 0.24 while the estimate of production is: 1:0.24:0.06 (data from Academy of Agricultural Sciences). Thus, if we keep using the old development schemes, China will not be able to solve this problem of disharmonious N=P=K ratio in 2000. This disharmony of the chemical proportions not only affects agricultural output increases in low P and K [soil] regions but also reduces the effectiveness of nitrogen fertilizers. Based on estimation of China's present needs for P and K, we are consuming about 80 percent of P and K from the soil itself and such a situation should not last long. Thus, we must take action to improve P and K fertilizers. There are three suggestions to be considered: 1) using our natural resources better; 2) increasing imports as necessary; and 3) encouraging the use of organic fertilizers.

III. Problems of Improving the Average Effective Nutrient Contents of Chemical Fertilizers

Affected by various factors, for some time, average effective nutrient contents in domestic fertilizers had been dropping rather than increasing. Some areas showed less than 10 percent P_2O_5 effectiveness. This phenomenon still exists even though some progress has been made in recent years. It would probably be alarming just to estimate the big loss in manpower, material resources, and extra burden imposed on farmers. Besides, even if China's chemical fertilizers meet standard requirements, the average efficiency level is still low due to product structures. The author has not seen official statistics. The effective nutrient percentage of China's fertilizers in 1980-1981 is estimated at about 20 percent, which was probably the international standard level in the 1940s (the United States was 20 percent in 1940). Many countries have been working for years to improve effective nutrient content and showing good progress. Table 3 shows average effective nutrient contents of chemical fertilizers for some countries. There are two reasons for improving average effective nutrient content: 1) to produce higher concentration mixed fertilizers; and 2) to reduce packaging and transportation costs. For instance, U.S. 8-16-16 mixed fertilizer was 60 percent cheaper than the 5-10-10 in packaging cost. The USSR stated that if they can increase the effective nutrient content by 10 percent, they can save 7 million ton-kilometers of transportation cost for every 100 million tons of nutrients. This means a saving of about 22 million rubles in packaging and storage. China is a country with a vast territory. Transportation is largely done by land, even by manpower, and is in great demand. Thus, the increase of average nutrient content in fertilizer would also contribute greatly to China's economy. To improve effective nutrient contents, China has to try hard to change the fertilizer structures. This brings about the inevitable involvement of the product variety problems of compound fertilizers and simple fertilizers.

Table 3. Primary nutrient content (%) in some countries

	1965	1970	1975	1980
United States	36.24	41.96	43.25	45.57
United Kingdom	29.77	33.85	33.64	37.10
France	31.0	33.88	34.67	36.87
West Germany	28.6	30.6	30.9	31.5 (1979 figures)
USSR	26.5	39.86	35.64	37.94

IV. Properties of Compound Fertilizers

Some irregularities in the usage of terminology exist both at home and abroad, therefore, the terms are clarified as follows:

Compound fertilizer--fertilizer prepared by chemical processes and containing at least two of the nutrients N, P or K, such as phosphamidon.

Simple fertilizer--fertilizer that contains only one nutrient out of the three key elements.

Mixed fertilizer—mechanically mixed product containing simple chemical fertilizers or compound fertilizers.

People at home and abroad are now concentrating on the development of compound and mixed fertilizers. The percentages of compound fertilizer in the total fertilizer production by weight in some countries are as follows: United Kingdom, 79, United States, 67; France, 61; and West Germany, 51.

The percentages by weight of products of mixed fertilizer are even higher. For instance, the percentage figures were 81 for P, 84 for K, and 32 for N some 20 years ago (1964) in the U.S.A. In recent years, 90 percent of P and K and 50 percent of N fertilizers were produced in the mixed form in Europe and Japan. According to the International Chemical Fertilizer Center, P mixed fertilizer was estimated to reach 65 percent in developing countries and 86 percent in developed countries (which was 62 percent in 1978) by the year 2000. The production of compound fertilizers in China has just begun. China produced 12,000 tons of P_2O_5 in 1979. Nothing has been done on mixed fertilizers. China imported 310,000 tons of 15-15-12 mixed fertilizer and 100,000 tons of phosphamidon (16-48-0) compound fertilizer in 1978.

We suggest that phosphamidon and phosphorus nitrate fertilizer products are to be developed first in China. China does have plenty of experience in both production and utilization of phosphamidon, which has been proven by experiments to be a good product. Problems arise because its production requires H_3PO_4, the need to have that is, H_2SO_4 or a power source. The advantage of phosphorus nitrate fertilizer is that it does not consume H_2SO_4, and HNO_3 was easy to obtain. After removal of calcium nitrate, the content of N and P was about 45 percent. This is good for acidic soil but neutral soil and limed soil require over 50 percent water-soluble P and 1- to 2-mm diameter particulate. Phosphorus nitrate fertilizer is not usable for paddy rice because of severe denitrification which lowers the nutrient value of N to less than 10 percent. Hence, H_3PO_4 fertilizers are best for use on northern and southern arid land crops.

To develop phosphamidon production, we have to learn if it is possible to use HCl to obtain H_3PO_4. It is said that it is industrially feasible in some countries.

The development of compound and simple fertilizers should not conflict. Based on the status of agricultural production, [soil] areas which lack P and K require only N nutrient fertilizer. The use of N nutrient fertilizer is also good for P-lacking [soil] areas to produce agricultural crops such as paddy rice. The production of leguminous plants and green manure need only P fertilizer. Therefore, while we develop compound fertilizers we should not ignore the production of simple fertilizers. The concept that compound fertilizer was more nutritious than simple fertilizer was wrong. Actually, under the same nutrient conditions, they function the same.

In order to apply different proportions of N, K and P fertilizers in soil and agricultural crops, the development of mixed fertilizer is also necessary and must be produced in a scientific way based on a reasonable mixing ratio. Some

places now are producing N, P and K mixed fertilizers blindly without considering the needs of the area; which may waste a lot of precious materials that the farmers will have to pay for. The production of mixed fertilizers must therefore, be regulated and must follow certain formulas. It is good to develop compound and mixed fertilizers at the same time, because the use of only compound fertilizer in the current agricultural situation may become wasteful, especially (when the nutrients are transported from elsewhere). The direct use of synthetic fertilizers still requires some technical advice.

It is best to develop both compound and simple fertilizers simultaneously. This is because the direct application of compound fertilizer often becomes a waste under the current agricultural situation. It is particularly true when compound fertilizers have high nutrient.

V. Pertaining to the Product Variety Problem of Simple N, P, and K Simple Fertilizers

N fertilizer--its product variety development is relatively clear-cut, i.e., emphasis is to be on urea. At the same time, prior to mechanization of agriculture, developing anhydrous ammonia, in certain areas should be explored. Of course nitramine must be developed. Ammonium carbonate will still be around for some time.

P fertilizer--development depends on China's natural resources and probably import conditions. Under certain circumstances, we must produce high-concentration P fertilizers, such as heavy calcium, however, we also need to develop some low-concentration P fertilizers such as common Ca, Mg-Ca and defluorinated P fertilizer to fully utilize our P mineral. Besides, we need to improve the specific weight of water-soluble P fertilizer particulates, since they are good for both acidic and limed soils and are convenient to use. In 1980, 90.1 percent of P fertilizer in the USSR was in particle form while ours was in powder form.

K fertilizer--development is relatively simple with KCl as the major product variety. Only a few major economical crops use K_2SO_4. We also need to search for K mineral ores.

The above opinion is based on the agricultural status. It is necessary to point out that this by no means has covered every aspect.

12864
CSO: 4008/1033

PHYSICAL SCIENCES

HYDROGEN DIFFUSION, POSITRON ANNIHILATION IN 40CrNiMo STEEL

[Article by Du Fengmu [2629 7685 3665], Gui Jianian [2710 0857 1628] and Wang Zixiao [3769 1311 1321]]

[Text] The 40CrNiMo steel has superior overall mechanical and technological properties and is mainly used as material for aeronautical applications. Various quenching and tempering treatments can be used to meet different strength and tenacity requirements. It is important to study the diffusion behavior of hydrogen in this material and its ability to resist hydrogen losses. In this article, the electrochemical permeation method[1] was used to determine the effect of tempering temperature on the diffusion coefficient and surface solubility of hydrogen, which were compared with the Doppler broadening line pattern parameter S in positron annihilation parameter and the hydrogen diffusion behavior was confirmed.

The materials for the experiments were quenched at 840°C and cut into 0.5mm-1.0mm thick slices by line cutting machine, and then kept at different temperatures (100-700°C) for an hour and tempered with air-cooling. All samples were smoothed by metallographic sand papers before being chemically polished to remove the deformed surface layer. The diffusion coefficient D and surface solubility C of 'hydrogen were determined by the electrochemical permeation method and the Doppler line pattern parameter of positron annihilation by the high-resolution Ge(Li) γ spectroscopy, whose energy resolution for the 570 KeV γ radiation of ^{207}Bi is 1.5 KeV. The system gain is equivalent to 73.6 KeV per channel and the total counts under the peak is greater than 10^6. The experimental results were expressed in spectral line pattern parameter S, which is the ratio of the area of the middle section of the peak as defined by appropriate channels to the total areas of both flanks.

Figures 1 and 2 showed the effects of tempering temperature on the diffusion coefficient D and surface solubility C of hydrogen in 40 CrNiMo steel. The changing patterns agree with the results of Y. Sakamoto and K. Takao.[2] Figure 3 showed the effect of tempering temperature on the parameter S and Figure 4 the effect on the hardness of 40CrNiMo steel.
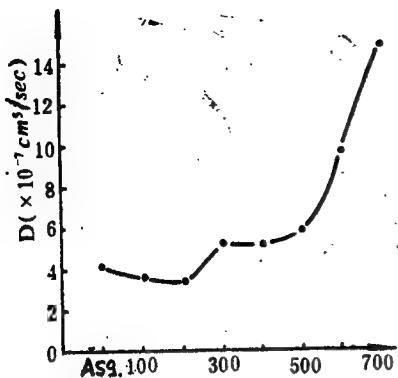
Figure 1. The Effect of Tempering Temperature on the Diffusion Coefficient D in 40CrNiMo Steel
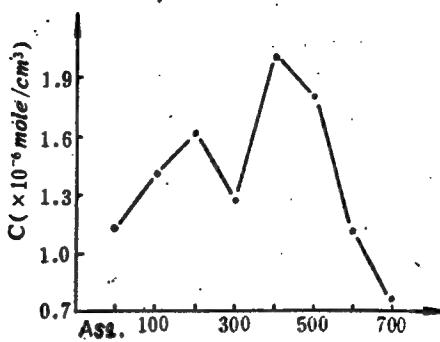
Figure 2. The Effect of Tempering Temperature on the Surface Solubility C in 40CrNiMo Steel
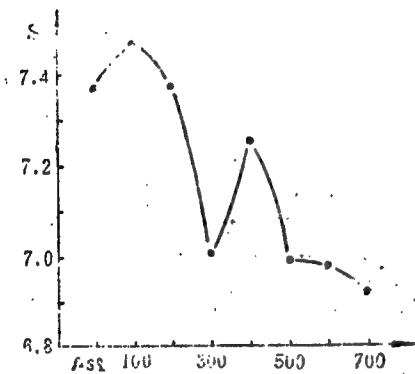
Figure 3. The Effect of Tempering Temperature on the Parameter S of 40 CrNiMo Steel
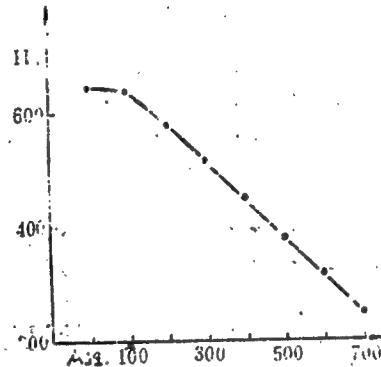
Figure 4. The Effect of Tempering Temperature on the Hardness of 40CrNiMo Steel

It can be seen from Figures 1, 2 and 3 that there are corresponding changes of D, C and S with the change of tempering temperature. The D value is smaller and S value larger in quenched martensitic state. This is because the quenching structure consisted mainly of the slat-shaped, dislocated and kinky martensites and partly of the sleet-shaped, twinned martensites and contain more quenching voids. These lattice defects can capture hydrogens and positrons.

When tempered at 100° and 200°C, there are no obvious changes of D, C and S. But at 300°C, D increases and S decreases with the change of S becomes more obvious. Tempering at 300°C corresponds to the tempering embrittlement region of the material. This seems to imply that the parameter S is more sensitive to the change of microstructure that accompanies tempering embrittlement.

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Beginning at 400°C, the rise in tempering temperature results in the increase of D and decrease of C and S. This is due to the great reduction of such defects as dislocation and twin crystal in martensite when tempered at temperature over 400°C. The carbonized material points grow, the structure becomes coarser and the phase boundary decreases noticeably, which results in gradual decrease in the number of sites in the material that capture hydrogens and positrons.

According to Figure 4, the change of hardness reflects the changes in internal organization and structure during tempering process and has nearly linear relationship with the change of D. Since the dislocations and voids introduced with the phase change of martensite, the hypoeutectic boundary and the interphase boundaries all change with tempering temperature, the influences of the steel's microstructure on the diffusion and adsorption of hydrogen and the positron annihilation are more apparent. The fact that there is a good correlation between the hydrogen diffusion behavior and the positron annihilation parameter indicates that at low hydrogen diffusion, the contributions from the effect of hydrogens filling in and the effect of positron captures at defective sites are nearly equal. Because part of the hydrogens in the material exist in cationic form[3] and that protons and positrons are identically charged, the positron annihilation parameter does provide to certain extent information about the diffusibility and solubility of hydrogen in the material. The positron annihilation technique can be used to study hydrogen embrittlement and probably tempering embrittlement.

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APPLIED SCIENCES

SHANGHAI TO REGULATE CITY FREIGHT TRANSPORT BY COMPUTER

Shanghai JIEFANG RIBAO in Chinese 22 Jan 84 p 1

[Article by correspondent Jiang Daqiao [1203 6671 2890]]

[Text] This municipality achieved success in the use of electronic computers for dispatching the city's cargo transportation automotive unit--a first in the nation. This municipal cargo transportation automotive unit dispatching computer system was successfully developed with the support of the Communications and Transportation Bureau's Staff University's Computer Technology Research Laboratory in the municipality, Fudan University, and other concerned units.

All that could be seen in the electronic computer room were operating personnel entering customer transportation order numbers, type of cargo, loading and unloading locations, vehicle tonnage, and other data into the electronic computer. After a few seconds, the electronic computer enters the results of the computations into the "Chinese (Language) Information Processing System" beside it. In hardly a moment, a route schedule in Chinese characters appears as a printout. Electronic computers are able to select the best vehicle dispatching scheme in a short time, also raising the economic benefit of vehicle units as a consequence.

Last October [1983], this electronic computer system was tested in the 6th Vehicle Unit of the 12th Transportation Park of the Shanghai Municipality, where it was compared with manual dispatching. The planned vehicle mileage utilization rate was raised by 4.8 percent, each month's empty vehicle mileage could be reduced by 6,000 kilometers, and 1,300 litres of fuel could be saved. In the latter part of last December [1983], the Municipality Scientific Committee evaluated and approved this achievement in scientific research. On 11 January of 1984, the Municipality Communications and Transportation Bureau convened a work-site conference to introduce and promote this achievement in scientific research. According to our understanding, should the Municipal Automotive Transportation Corporation apply electronic computer dispatching totally, each percent rise in veicle mileage utilization could increase income by 1 million yuan, including saving more than 700,000 liters of fuel.

8174
CSO: 4008/266

APPLIED SCIENCES

CHINA REACHES NEW LEVEL IN MINICOMPUTER DEVELOPMENT

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 15, 8 Aug 85 p 1

[Anonymous: "S-8/10 Computer System Passes State Appraisal"]

[Text] Institute 706 of the Ministry of Astronautics Industry succeeded in developing China's first S-8/10 computer system with a performance capability comparable to the international level of similar products of the early '80's. The system passed the state evaluation on 25 July in Beijing. Its development marks a new level in China's work in developing minicomputer systems.

The S-8/10 computer system has a large degree of modularity in hardware and software. Its system configuration employs distributed processing. The system configuration is flexible and can be upgraded in the field. The system's instruction set is complete, and the addressing system is flexible. The hardware and software resources are abundant. Its largest physical internal storage reaches 2 MB and its external storage reaches 1200 MB. The operating system of this machine can support time-sharing, real-time, and batch processing operating simultaneously under a multiuser, multitasking environment. It can also support many types of programming languages. The system has high capability in communication processing and also is equipped with a network model management system and a distributed processing remote network system. This system can be connected to a Chinese-character terminal, which in operation, can support Chinese information processing. This system can also be fitted with a stronger diagnostic program system and can perform fault detection, and location to the sub-board level within multiple levels and multiple environments. System maintainability is very high.

CSO: 4008/1005

APPLIED SCIENCES

STABILITY ANALYSIS OF ELECTRON TRAJECTORIES IN FREE-ELECTRON LASERS

[Article by Wang Yuandian [3769 0337 3013], Institute of Space Physics, Chinese Academy of Sciences: "Stability Analysis of Electron Trajectories in Free-Electron Lasers With an Axial Magnetic Field"]

[Text] Abstract: Stability of electron trajectories in free-electron lasers with an axial magnetic field is analyzed in this paper. The results show that in the case of noncyclotron-resonance ($\omega_0 \neq k_0 \gamma_z$), the trajectories are unstable if the condition $(\omega_0 - k_0 \gamma_z)/(2\omega_\omega)^2 = 1$ is satisfied, while in the case of cyclotron-resonance ($\omega_c = k_0 \gamma_z$), the trajectories are always stable if the initial perpendicular velocities of electrons are small. On the other hand, oscillation amplitudes of the parallel velocities of electrons depend on the ratio B_ω/B_0. The smaller the ratio, the smaller the oscillation amplitudes.

I. Introduction

To inhibit the expansion of an electron beam in the propagation process, sometimes an axial magnetic field is introduced in a free electron laser. The introduction of the axial magnetic field gives the electrons a motion rotating around the line of magnetic force. This movement, coupled with the movement of the electrons in the transverse oscillating magnetic field, creates a very complex state for transverse velocity modulation and longitudinal velocity modulation. The properties of this state are determined by the selection of experimental parameters. Generally speaking, the parallel velocity of an electron oscillates around an average value. Sometimes the oscillation amplitude is also very great and this type of high amplitude oscillation can lead to broadening of the spectral line and influence the propagation of the electron beam. In addition, within the spatial range of some special parameters, after entering the action region, the parallel velocity of a group of electron beams which have very narrow initial parallel velocity stretching can rapidly begin to disperse leading to a very great velocity stretching. We call this situation the instability of electron trajectories.

Some analyses of the problem of stability of electron trajectories has already been done. Friedland's analysis[1] is rather brief and does not take into consideration the initial transverse velocity dispersion of electrons, and the expressions of transverse velocity that he adopts do not have universality. Freund and Drobot carried out more universal analyses,[2] but due to the complexity mathematically, no simple stability criteria were given. This paper uses some rational mathematical approximations to derive a group of parameters so that the determination of stability is clear and simple. We further explain the physical essence of electron trajectory stability and further discuss the selection of parameters to insure normal operation of the laser.

II. Analysis of Electron Trajectory Stability

If we take the z axis as the direction of the axial magnetic field, then the general magnetic field can be expressed as

$$\mathbf{B} = B_0 \mathbf{k} - B_\omega (\mathbf{i} \cos k_0 z + \mathbf{j} \sin k_0 z), \tag{1}$$

in which B_ω and k_0 are the amplitude and wave number, respectively, of the oscillation field. The equation of movement of the electron is

$$\frac{d\mathbf{p}}{dt} = -e \frac{\mathbf{v} \times \mathbf{B}}{c} \tag{2}$$

Multiplying both sides of Equation (2) by p we can derive p = constant. Thus the relatively factor γ is unchanged. From Equation (2) we can also derive another movement constant,[3] i.e., the longitudinal invariant.

$$\left(\frac{k_0 v_z}{\omega_o} - 1\right)^2 - \frac{2ck_0}{eB_0^2} m\gamma v_\perp B_\omega \cos\psi = \left(\frac{k_0 \mathscr{V}_z}{\omega_o} - 1\right)^2 \tag{3}$$

in which $\mathscr{V}_z$ is the initial longitudinal velocity of the electron, $\omega_0 = eB_0/(m\gamma c)$, m is the resting mass of the electron, $\psi = \varphi - k_0 z + \pi$ in which φ is the included angle of $v_\perp$ and i, thus ψ represents the included angle between $v_\perp$ and B_ω. Since the overall velocity of the electron does not change, we have $v_z^2 = \mathscr{V}_z^2 + \mathscr{V}_\perp^2 - v_\perp^2$, in which $\mathscr{V}_\perp$ is the initial transverse velocity, noting that $|\mathscr{V}_\perp^2 - v_\perp^2| \ll \mathscr{V}_z^2$, then $v_z \cong \mathscr{V}_z [1 + 1/2(\mathscr{V}_\perp^2 - v_\perp^2)/\mathscr{V}_z^2]$, and after substituting this relationship in Equation (3) and collating, we get

$$\frac{\omega_o}{4k_0 \mathscr{V}_z} \frac{v_\perp^4}{\mathscr{V}_z^2} + \left(\frac{\omega_o}{k_0 \mathscr{V}_z} - 1 - \frac{1}{2} \frac{\omega_o \mathscr{V}_\perp^2}{k_0 \mathscr{V}_z^3}\right) v_\perp^2 - 2\frac{\omega_w}{k_0} v_\perp \cos\psi$$

$$= \left(\frac{\omega_o}{k_0 \mathscr{V}_z} - 1 - \frac{\omega_o}{4k_0 \mathscr{V}_z} \frac{\mathscr{V}_\perp^2}{\mathscr{V}_z^2}\right) \mathscr{V}_\perp^2, \tag{4}$$

in which $\omega_w = eB_w/(m\gamma c)$. For the convenience of the discussion we have divided Equation (2) into component form:

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$$dv_\perp/dt = -\omega_w v_s \sin \psi,$$

$$d\psi/dt = \omega_c - k_0 v_z - \omega_w (v_z/v_\perp)\cos \psi,$$

$$dv_s/dt = \omega_w v_\perp \sin \psi.$$

Below we will discuss the noncyclotron-resonant and cyclotron-resonant situations separately.

1. Noncyclotron-resonant situation ($\omega_c \neq k_0 \mathscr{V}_z$)

Since $v_\perp \ll \mathscr{V}_s$, $\mathscr{V}_\perp \ll \mathscr{V}_s$, when ω_c does not approach $k_0 \mathscr{V}_z$, comparing the size of the terms in Equation (4) it can be further simplified to

$$[(\omega_c/k_0 \mathscr{V}_s) - 1] v_\perp^2 - 2(\omega_w/k_0) v_\perp \cos \psi = [(\omega_c/k_0 \mathscr{V}_s) - 1] \mathscr{V}_\perp^2 \tag{8}$$

and combining Equations (7) and (8) and utilizing $v_\perp^2 = v^2 - v_z^2$ we can get

$$(du/d\tau)^2 + (1 - 2\sigma) u^2 + \sigma u^4 - (1 - \sigma + \delta) = 0, \tag{9}$$

in which $u = v_z/\mathscr{V}_s$, $\tau = t\omega_w$, $\sigma = (\omega_c/k_0 \mathscr{V}_s - 1)^2 \mathscr{V}_z^2/(2\omega_w/k_0)^2$, $\delta = \mathscr{V}_\perp^2/\mathscr{V}_z^2 \ll 1$

There is a simple explanation for Equation (9): $(du/d_T)^2$ can be viewed as the kinetic energy of the "particle", $V(u) = (1-2\sigma) u^2 + \sigma u^4 - (1-\sigma+\delta)$ can be viewed as the potential energy of the "particle," thus Equation (9) explains simply that the overall energy is conservative and its value is zero. Below we will only analyze the features of V(u) in order to understand the movement properties of the "particle," which is really a spatial analytical method.

V(u) can have four different real roots, a pair of real roots, a pair of conjugate complex roots and three real roots. The third situation means that a pair of real roots combines into one. For the time being we will overlook the minute quantity δ, and from simple identification we can know that when $\sigma > 1$, there are four different real roots; when $\sigma < 1$, there is a pair of real roots and a pair of conjugate complex roots; when $\sigma = 1$, there are three different real roots. The potential energy curves V(u) which correspond to these three situations are illustrated in Figure 1. From Equation (9) it can be seen that only V(u) < 0 is a possible area of motion because $(du/d_t)^2 \geq 0$. At this time there are two separated areas of motion, and if we suppose the initial velocity of the electron to be $\mathscr{V}_z > 0$, then the electron can only be within the area of motion of the slanting lines in the illustration. Clearly the range of variation in longitudinal velocity u is $u_1 - u_2$, and oscillates around the equilibrium point u_0. Because there is a potential barrier between the two areas of motion, the electrons cannot enter one area of motion from the other. If σ is gradually reduced, we see how the V(u) curve changes. First of all, the range of variation of u becomes greater, i.e., u_1 gradually becomes small, thus the oscillation amplitude of u becomes larger. Next, the barrier between the two areas of motion becomes lower and when $\sigma = 1$, the barrier is completely eliminated, and the two areas of motion begin to be connected. $\sigma = 1$ corresponds to a critical state, and when σ is

slightly larger than 1, the electrons can only move within the area of motion, and the oscillation range of u is probably 0-1. But, when σ is slightly less than 1, the electrons can move within the connected area formed by the two areas of motion, and the oscillation range of u is probably -1 ~ 1. Supposing an electron with $\sigma \cong 1$, after undergoing some perturbation, the motion of the electron may leap from the $\sigma > 1$ state to the $\sigma < 1$ state of the reverse. The result of this might lead to a great change in the oscillation amplitude. If the electron beam is injected under the $\sigma \cong 1$ conditions, since the electron beam has a small initial parallel velocity stretching, this is equivalent to having a small stretching range, and thus the σ of some electrons will be slightly greater than 1 and the σ of some electrons will be slightly smaller than 1. Because the difference in the oscillation amplitude of the two is very great, after entering the action area, the longitudinal velocity can disperse very quickly and the dispersion will be very great. This is why this trajectory is termed an unstable trajectory. Therefore, we have reached the conclusion that the trajectory corresponding to $\sigma = 1$ is unstable. When σ continues to diminish, V(u) can only have two real roots, and in the strict sense, this trajectory is stable, but the oscillation amplitude of u is comparatively great.
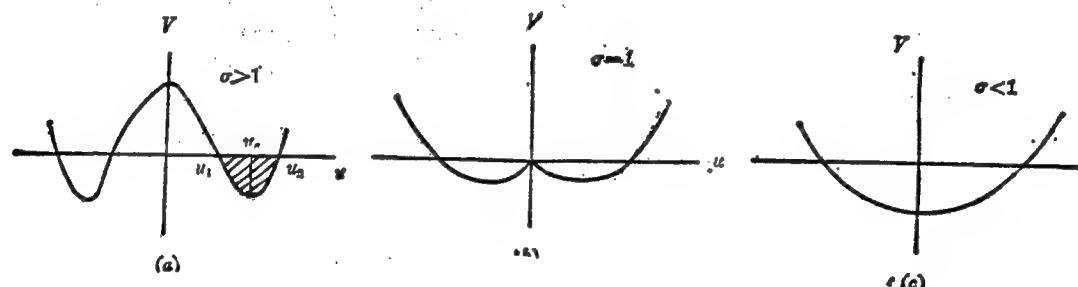
Figure 1. Potential V(u) With σ as Parameter

In the above analysis we ignored the influence of the electron's initial transverse velocity. If we take δ into account, we can know that $\sigma = 1 + \delta$ corresponds to an unstable trajectory. It can be seen that the initial transverse velocity has a tendency to lead to instability.

The physical image of what makes it possible for v_z to oscillate is very clear, it is the subjection of the axial electrons to the action of a Lorentz force, $F_z = -(e\mathbf{v_\perp} \times \mathbf{B}_\omega)/c$. From Equation (7) it can be seen that the size and direction of this force is determined by the included angle between v and $\mathbf{B}_\omega$. The periodic changes in ψ lead to the periodic acceleration and deceleration of the electron in the axis, i.e, v_z oscillates around an average value. Yet the changes in ψ are determined by the laser's working parameters (B_0, B_ω, k_0 and $\mathcal{V_z}$). The situation is different with nonaxial magnetic fields. At such times, the rotational motion of the electrons is jointly controlled by $\mathbf{B}_0$ and $\mathbf{B}_\omega$ and, generally speaking, the electrons cannot be precisely synchronous with $\mathbf{B}_\omega$. This point is very easily realized in the free electron lasers with nonaxial magnetic fields, only the initial transverse velocity of the electrons is very small and after entering the action area, we have $\mathbf{p_\perp} = e\mathbf{B}_\omega/ck_0$, i.e., $\mathbf{v_\perp}/\mathbf{B}_\omega$, and the size does not change. Yet in situations

where there is an axial magnetic field, not only does the included angle ψ of $\mathbf{v}_\perp$ with $\mathbf{B}_\omega$ change in period, but the size of $\mathbf{v}_\perp$ also changes periodically. As concerns asking why the trajectory corresponding to $\sigma = 1$ is unstable, one only need analyze the combination of Equations (5), (7) and (8) to obtain an answer. It is easy to see that when $\sigma < 1$, the electrons can be greatly accelerated or decelerated, and this process can lead to a change in the v_z symbol, thus the oscillation amplitude of v_z is greater and when $\sigma > 1$, the oscillation amplitude should be much smaller, and $\sigma = 1$ corresponds to the transition between these two situations.

2. Cyclotron-resonant situation ($\omega_0 = k_0 \mathcal{V}_z$)

Now we combined Equation (3) with Equation (7), eliminate $v_\perp$ and ψ and obtain the equation which contains the unknown function v_z

$$\left(\frac{d\eta}{d\tau}\right)^2 + \left(\frac{B_0}{2B_\omega}\right)^2 \eta^4 + (\eta+1)^2 - A^2 = 0 \tag{10}$$

in which $\eta = (k_0 v_z/\omega_0 - 1)$, $A = k_0 v/\omega_c$, v is the size of the electron's velocity. If the electron's initial transverse velocity $\mathcal{V}_\perp$ is very small, then $v \cong \mathcal{V}_z$, and in accordance with the cyclotron-resonance condition $A \cong k_0 \mathcal{V}_z/\omega_c = 1$. If the equation is written in the form $(d\eta/d\tau)^2 + V(\eta) = 0$, then the "potential energy"

$$V(\eta) = \left(\frac{B_0}{2B_\omega}\right)^2 \eta^4 + \eta^2 + 2\eta \tag{11}$$

in which the curve of $V(\eta)$ is as illustrated in Figure 2, and it can only have two real roots. Therefore under the above described hypothetical conditions, there is no problem of instability of trajectory. However, the oscillation amplitude of the longitudinal velocity $\mathcal{V}_z$ is determined by (B_0/B_ω). When this ratio is larger, the oscillation amplitude is smaller.
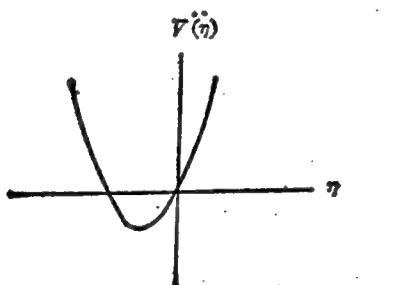
Figure 2. Potential $V(\eta)$ When $\omega_0 = k_0 \mathcal{V}_z$

III. Conclusion

From the above discussion we can draw the following conclusions:

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1. For the noncyclotron-resonant working mode ($\omega_0 \neq k_0 V_z$), the trajectory corresponding to $(\omega_0 - k_0 V_z)^2 / (2\omega_\omega)^2 = 1$ is unstable. The electron beam injection conditions should avoid the vicinity of this point.

2. For the cyclotron-resonant working mode ($\omega_0 = k_0 V_z$), if the initial transverse velocity of the electron beam is very small, there is no problem of trajectory instability. But if (B_ω/B_0) are smaller, then it can make the oscillation amplitude of v_z smaller. But if the values of (B_ω/B_0) are controlled by factors (such as gain efficiency), the factors should be balanced to determine their size.

Finally, it should be pointed out that generally speaking, the situation in which the oscillation amplitude of v_z is very large is not anticipated. However, in terms of the electron beam, this oscillation is not random, but is a collective property. Its influence on the gain and efficiency of lasers is not yet clear because of its complexity and very few people have carried out analyses theoretically as of yet. Up to now the people who have done theoretical analyses have taken the jijie [1142 6043] of Equations (5)-(7) $\varphi = 0$, $v_z = $ constant, $v_\perp = \omega_\omega v_z (\omega_0 - k_0 v_z)$ as the undisturbed trajectory of the electrons. Or, like McMullin and Davidson, they have felt that making a small amplitude oscillation around the balance point is a simple harmonic approximation.[4]

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APPLIED SCIENCES

'DIALOG' AT SHANGHAI JIAOTONG UNIVERSITY

Shanghai JIEFANG RIBAO in Chinese 25 Jan 84 p 1

[Article by reporter Xu Chengzi [1776 2052 3320]]

[Text] The Shanghai Jiaotong University connected a terminal to the "man-machine conversation" (DIALOG) information retrieval system of the Lockheed Missile and Space Corporation in the United States, that requires only from several minutes to over 10 minutes to find specifically required information from among the thousands and tens of thousands of items of reference material in various languages. Yesterday (the 24th) this terminal formally retrieved material for the first time for scientific research topic teams in the university. This is the first information retrieval terminal known in this municipality with international computer connections, and is able most quickly and most comprehensively to search out the newest scientific, technological, and economic information on a worldwide scale.

The Shanghai Jiaotong University and the DIALOG system located in Palo Alto in the State of California in the United States, are 10,000 li apart. Last October [1983], after both parties signed the contract to implement retrievals through a computer link, a teleprinter was installed in the library of the Jiaotong University to serve as the terminal so that, through telephone lines and communications satellites, Jiaotong University could retrieve material from the literature data base at the distant end. Reporters there yesterday witnessed the Jiaotong University operator turn on the machine, place a call to the literature data base at the distant end, and, after finding material pertaining to the four subject areas of dynamics, shipping, applied mathematics, and computer networks, a total of 116 articles meeting the requirements of the search was immediately printed out on the Jiaotong University's teletype terminal. At this time, the operator notified the distant end to print out the entire selection and mail it to the university, after which the "man-machine conversation" was completed, taking a total of 20 minutes, averaging 5 minutes per subject search. It is also understood that, when there is a special requirement, the distant end may also be requested to print out the required selections directly on the teleprinter.

In welcoming this new challenge of the technological revolution, Jiaotong University saw that right now over 70,000 periodicals are already published in various countries, over 5 million scientific and technical papers are

published each year, nearly a million patents are published each year, and references from various professions and fields of study overlap so that merely relying upon manual searching for material would not only expend one-third to two-thirds of the research time of scientific and technical personnel, but would still not permit complete and accurate search. Completion of the international computer retrieval access terminal could expedite the development of research work. The person responsible for the Jiaotong University Library told reporters that the international computer connection for information retrieval currently serves Jiaotong University instruction and scientific research, but will soon be open to scientific research units of the entire municipality.

It is known that this American DIALOG information retrieval system's terminals are located all over the world. Before Jiaotong University, our country's construction materials, petroleum, chemical industries, metallurgy, and other areas' units concerned had already rented it [engaged the service], and from terminals established in Beijing or Hong Kong retrieved needed material. The literature data base of this system has more than 75 million references in such areas as the natural sciences, social sciences, commerce, and economics, which number places it first in the world.

APPLIED SCIENCES

SHANGHAI PARTY LEADERS INSPECT PLANTS

Shanghai JIEFANG RIBAO in Chinese 1 Jan 84 p 1

[Text] On new year's eve [1983], Shanghai Municipal Party Committee of the
Chinese Communist Party and Municipal Government leaders Chen Guodong [7115
0948 2767], Hu Lijiao [5170 4539 2403], Yang Ti [2799 1029], Wang Daohan
[3076 6670 3211], Ruan Chungwu [7086 1504 2976], Li Zhaoji [2621 5128 1015],
and others, successively inspected the Shanghai Components Plant No 5,
Shanghai Computer Plant, Shanghai Automotive Plant and other units to under-
stand the current production and development status.

On 28 December [1983], the leaders of the Municipal Committee and the Munici-
pal Government went successively to the Shanghai Components Plant No 5 and
the Shanghai Computer Plant. At Shanghai Components Plant No 5 they saw a
large-scale integrated circuit lead line (also termed an intermediate test
line) which had just begun to run, and received an on-the-spot report from
the original Plant Manager Chen Renjin [7115 0088 6930] who is now second
in command. Aside from the photoetching machine, diffusion furnace, and the
ion implantation device for this lead line are imported, the 32 types of
equipment such as the plasma etching machine and the aluminum etching machine
are all manufactured as complete sets of equipment in China. The basically
successful completion of this large-scale integrated circuit lead line will
provide the technical conditions for the development of large-scale integrated
circuits. The Municipal Committee and Municipal Government leaders expressed
satisfaction with the preliminary achievements in this factory in the develop-
ment of large-scale integrated circuits. Wang Daohan voiced two hopes to the
factory leadership: The first is that the application of large-scale inte-
grated circuits must be intensified. This is because without application
there can be neither promotion nor viability of development. After applica-
tion has been intensified, the current status of production exceeding demand
may be changed. The second is stability, first stabilizing the current 1K
integrated circuits, then developing in the direction of 4K to 10K, further
raising the production level of large-scale integrated circuits.

At the Shanghai Computer Plant, the Municipal Committee and Municipal Govern-
ment leaders saw such advanced electronics products as micro, medium, and
small electronic computers, Chinese character terminals, and telegraph trans-
lation equipment. They were extremely concerned over the development of this
plant, requesting expedited preparation of an integrated program and development

plan, and also requesting that the higher-level corporation and bureau bring to the municipality's attention for solution any problems requiring solution at the municipality level with respect to assisting this plant in assembling complete sets of equipment from developmental production organizations and [occupational] fields. With respect to promotion of application, Comrade Chen Guodong suggested they go into "rental" to establish a new route to promote the application of electronic computers, causing electronic computers to show benefits in applications, achieving development and broad use relatively quickly.

On 29 December [1983], Municipal Committee and Municipal Government leaders inspected the Shanghai Automotive Plant, viewing the "Shanghai—SANG TA NA" [2718 1044 4780] limousine assembly line and inquiring in detail as to the current production status of the Shanghai brand limousines as well as the situation regarding establishment of maintenance and repair stations throughout the country.

8174
CSO: 4008/266

APPLIED SCIENCES

CHINA'S FIRST MICROCOMPUTER CONTROLLED POWER STATION

Shanghai JIEFANG RIBAO in Chinese 15 Dec 83 p 1

[Article by Zhang Zhaofeng [4545 0340 6265] and Sun Lin [1327 2651]]

[Text] The Shanghai Electrical Technology Research Laboratory in cooperation with the Fudan University Microcomputer Development and Applications Research Laboratory used a microcomputer (which people generally refer to as a micro-electronic brain) as a constituent of China's first automated tidal energy power station--the Liu River Tidal Power Station, which opened a new road to automated control of China's small-scale hydroelectric power station.

Located in Taicang Xian in Jiangsu Province at the mouth of the Liu River, the Liu River Tidal Power Station is equipped with two 75-kilowatt generators and is designed to produce 250,000 kwh of electricity annually. Since incorporation into the network to generate power in July 1978, the rising and falling of the tide four times daily resulted in complex manual operation causing the need to have many persons to be on shift, poor management, and low effectiveness. Not only was the actual power generated less than one-fourth the designed capacity, but it was also not safe enough. To correct the backward aspect of manual control of small-scale hydroelectric power stations, in 1981 the Jiangsu Provincial Water Conservancy Bureau entrusted the Shanghai Electrical Technology Research Laboratory to develop a program-controlled automated arrangement which achieved an early stage of success this May [1983].

Just as the automated control system for small-scale hydroelectric power stations was successfully developed, the fleet pace of development of large-scale integrated circuit technology and the great drop in the price of micro-computers established conditions for its broad application. Scientific research personnel of the Shanghai Microcomputer Development Applications and Research Laboratory of Fudan University, with the foundation of the successful test of the automation of the control of a small-scale hydroelectric power station at the Liu River Tidal Electric Power Station, initiated research into the application of microcomputers in small-scale hydroelectric power stations. Exploring the possibility of leaping over certain states of traditional industrial development to develop directly the use of a new generation of technology.

In recent months, through the common effort of the scientific research personnel, with respect to the automated control of small-scale hydroelectric power

stations by microcomputers, promising results have been achieved in successfully replacing a program-controlled device worth over 1,000 yuan with a single-board microcomputer worth over 300 yuan (i.e., the control device, storage, and input-output components--three in all--concentrated on a single board).

When the tidal water level variation reaches 0.3 meter, Generator No 1 turns on automatically, gradually increasing speed, and when its speed of rotation reaches 90 percent, it automatically incorporates itself into the net to generate power. Following this, Generator No 2 turns on automatically, increases speed, and incorporates itself into the net to generate power. The whole process takes only 6 to 7 minutes, with all 16 programs controlled by microcomputers. If through further development the capabilities of measurement, monitoring, and control can be on the same single-board microcomputer, it can further replace speed-sensing devices, automatic frequency control devices, automatic speed regulators, and digital water level change measuring devices. Thus a single-board microcomputer with attachments, costing no more than 300 yuan, could replace automation equipment originally worth more than 8,000 yuan.

The experts and scholars attending the Liu River Tidal Power Station Evaluation Conference then in session all recognized that microcomputers have a vast vista before them in the application to small-scale hydroelectric power stations. The adoption of microcomputers will be a strong impetus to expedite development of China's hydroelectric resources and the realization of the electrification of agricultural villages.

8174
CSO: 4008/266

APPLIED SCIENCES

MICRO-POWER DISSIPATION DEVICE DESCRIBED

[Article by Mao Xingwu [3029 5281 2976], Zhou Likai [0719 4539 0418] and Zhou
Jianjun [0719 1696 6511] of the Shandong Linyi Semiconductor Device Plant:
"Micro-power Dissipation High-β and Super-β Devices and Their Applications"]

[Text] The common-emitter current gain β of a common two-pole transistor is
generally below 250. Traditionally they are referred to as high-β or high-
gain transistors when the β of such transistors exceeds 300. When the β of
a transistor is higher than 1,000, it is called a super-β transistor (SBT) or
super-gain transistor. The micro-power dissipation type has the widest
applications among the high-β or super-β devices. Micro-power dissipation
high-β or super-β devices mean that there is a high gain or a super-high gain
under a micro current (such as 1 μA). This type of device is widely used in
small signal-detection systems and stereo audio equipment because of their
characteristics of high gain, low frequency and low noise under small signals.

The β of silicon NPN-type 3DM high-β and super-β transistors and the EDM
super-β differential transistor is generally between 1,000 and 3,000 with
7,000 being the highest. The β of silicon PNP-type 3CM high-β transistors
and the ECM high-β differential transistor is generally between 300 and 700
with 1,200 being the highest. The two kinds of differential transistor EDM
and ECM have excellent symmetry, with an input oscillating untuned voltage
$V_{OS} < 1$ mV and an input oscillating current $I_{OS} < 2$ nA. These products, whose
major specification is very close to the U.S.-made MONO-MAT-01, AD815 and
2N3801, respectively, are the domestic leaders.

Major Characteristics of Micro-power Dissipation High-β and Super-β Devices

1. The β of both micro-power dissipation high-β and super-β devices decreases
with a decreasing I_c. Furthermore, the decreasing rate is very slow. Take the
3DM super-β transistor and the EDM differential transistor, for example. β can
still exceed 1,000 with a maximum higher than 3,000 even when I_c is below 1 μA.
This characteristic is even more prevalent in the PNP-type 3CM transistor and
ECM differential transistor. The low-current characteristic for β is even more
outstanding than that of the NPN-type high-β or super-β devices. β basically
does not decrease when I_c is lowered from 1 mA to 1 μA.

2. The low-frequency, low-noise current of the super-β device is very small. For instance, the low-frequency (0.1~100 Hz) noise current of 3DM and EDM is smaller than 2×10^{-13} A/$\sqrt{Hz}$. Under the condition when $I_c = 100$ μA, f = 120 Hz and $R_s = 500$ Ω, and when a U.S.-made 2173C-2181 transistor noise analyzer is used for testing, the noise coefficient N_F of the 3DM3 and 3CM3 high-β transistor is lower or equal to 0.5 dB, approaching the overseas standard for a low-frequency, super-low noise transistor.

3. All of the reverse breakdown voltages BV_{CEO} of 3DM, EDM, 3CM and ECM are larger than 15 V with a typical value of 35 V and a maximum value of 80 V, unparalleled by any ruptured-type devices. BV_{CEO} is entirely determined by the avalanche breakdown instead of the ruptured voltage. In addition, I_{CEO} varies very little with the increasing V_{CE}.

4. The reverse current I_{CEO} is generally 0.05~1nA, which is trivial compared with the working current of the device.

5. The input impedance of the high-β and super-β device is generally around 1 MΩ, a characteristic unparalleled by the common transistors.

6. The EDM and ECM high-β and super-β differential transistors possess excellent symmetry having an oscillating current $V_{OS} < 1$ mV and better ones of 0.1 mV, and having an oscillating current $I_{OS} < 2$ nA with the majority having less than 1 nA.

Because high-β and super-β devices have a high gain and super gain under a micro current, plus the fact that their reverse current is very small, therefore transistor precision measurement instruments have to be used in order to determine their parameters. As their working current is on a milliampere scale and the base current in a microampere scale, data used merely as reference can be provided when only a JT-1 type transistor characteristic oscilloscope is used for observation.

The saturated voltage drop V_{CES} will be relatively larger under a large current. However, when working under a milliampere current, the V_{CES} is still very small and hence will not cause any undesirable effect on the circuit quality.

Caution must be taken to avoid an avalanche breakdown at the emitter (EB) node when testing and using high-β and super-β devices, and therefore do not connect C and E in reverse. Like the common two-pole transistor, β will drop abruptly under a small current as soon as the avalanche breakdown has occurred at the EB node. In addition, after the avalanche breakdown has occurred at the EB node, the 1/f noise will suddenly increase, reducing the quality of low-frequency noise. In the physical determination of BV_{EBO}, an undesirable effect usually will not occur, provided that the reverse current through the EB node is controlled at a specific level (such as 100 μA). Manufacturing technology for 3DM, 3CM, EDM and ECM high-β and super-β transistors and differential transistors has assured that the reverse breakdown voltage at EB node BV_{EBO} is larger than 7 volts. Thus it is usually not necessary to detemine this parameter.

B-1 type metal caps are used to seal 3DM and 3CM, while EDM and ECM differential transistors are packaged using TO-6 or Y1-6B type metal caps. The arrangement sequence of the various terminals are shown, respectively, in (a), (b) and (c) of Figure 1 when the legs face up.

(a) B-1 type   (b) TO-6 type   (c) Y1-6B type
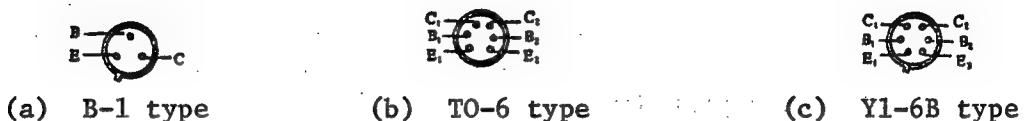
Figure 1.

Application of High-β and Super-β Devices

Currently high-β and super-β devices have been employed widely in various areas such as automatic controls in the high-precision instrument panel industry, low-signal detection, long-range navigation, sonar reception and stereo audio equipment. Nevertheless, few people have the overall knowledge about them at the present time. Restricted by traditional concepts about circuit design, these people perceive that the higher a transistor's β, the more unstable the circuit will become. As a matter of fact, such worry is needless. In actual applications, self-induced oscillation can be avoided if the appropriate measure is taken.

Figure 2. represents the recording-playing amplifier of a recorder. Two-transistor direct coupling is used for the input loop. T_1 and T_2 are 3DM3B low-noise high-β transistors with β = 400~800. The static collector current of T_1 is 70~120 μA. The gain of the recording-playing input loop made up of T_1 and T_2 can reach 45 dB. The signal-to-noise ratio and the gain of this machine would decrease by 5~8 dB if T_1 and T_2 were to be made up with common transistors 3DG201 or 3DX201.

Figure 2.

Key:
1. Play
2. Record
3. Recording/playing head
4. Four-fold amplification
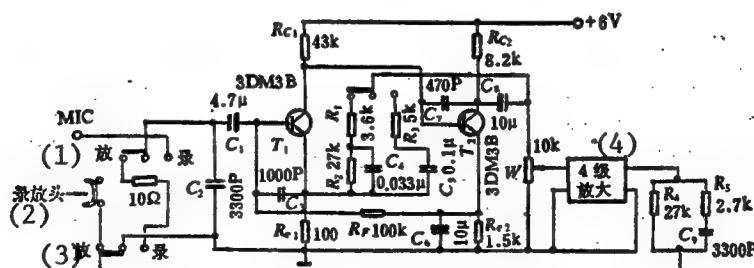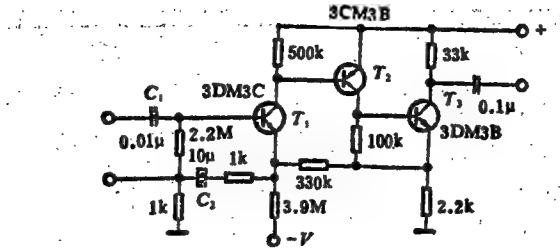
Figure 3.

Figure 3 represents a high-input impedance AC amplifier composed of 3DM3 and 3CM3 which has been used in an automatic steady-zero amplifier to amplify modulated signals. The working current of T_1 is approximately 1 µA under which $\beta \geqslant 500$; T_2's $\beta \geqslant 250$ with a static current of 5~10 µA; and T_3's $\beta \geqslant 400$ with a working current of 200 µA. The major specifications of the automatic steady-zero amplifier in using this AC amplifier are: input oscillating voltage $V_{OS} \leqslant 25$ µV, input oscillating current $I_{OS} \leqslant 0.1$ nA, oscillating voltage temperature drift $\leqslant 0.5$ µV/°C, input impedance $Z_i \geqslant 300$ kΩ and open-loop voltage gain $A_{od} \geqslant 140$ dB.
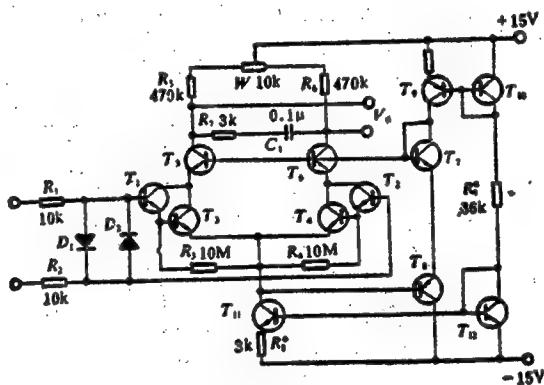
Figure 4.

Figure 4 displays the Darlington stage of a low-bias operation amplifier which falls in the category of common emitter-common base circuit. T_1 with T_2 and T_3 with T_4 are EDM super-β differential transistors while T_5~T_{12} are 3DM and 3CM high-β transistors, respectively. The collector current of T_3 and T_4 transistors is about 50 nA. The required β of T_1 and T_2 is larger than 250 under 50 nA. R_3 and R_4 provide a leakage path for the breakdown current I_{CEO} of T_1 and T_2. The low-bias operation amplifier composed of this circuit and the subsequent utility-integrated operations (such as BG305) has an input bias current of less than 200 PA, an oscillating current of lower than 10 PA, an open-loop gain above 140 dB and an open-loop input impedance of 6,000 MΩ. When configured into a precision current to a voltage conversion circuit using a voltage relay fashion it will have a sensitivity in current measurement up to 5×10^{-13} A.
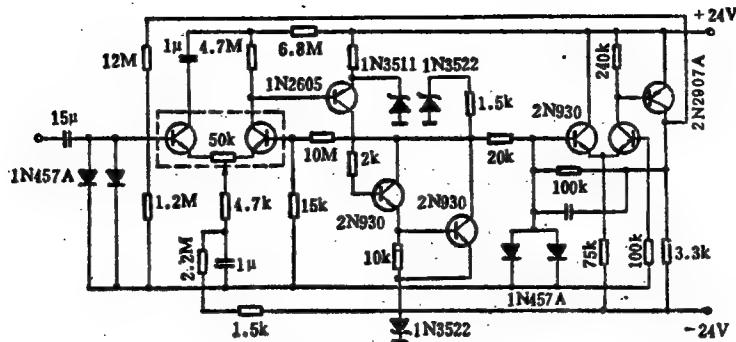
Figure 5.

Figure 5 is the differentiator circuit used in an American Boeing 707 aircraft cabinet pressure-controlling device. The open-loop amplification of this circuit is 3,000 with an input impedance larger than 5 MΩ, equivalent to less than 5 μV for noise voltage (peak to peak) at the input end. The above specifications could be easily realized if in this differentiator, the role of the input differential transistor is to be fulfilled by EDM2B whose β = 500, while 2N2605, 2N2907A and 2N930 are substituted, respectively, with less sophisticated high-β transistors 3CM1C and 3DM1C whose β = 200 approximately under a micro current.
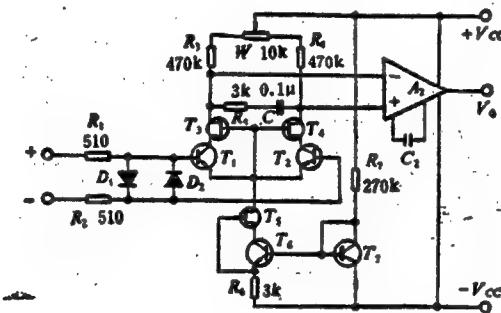
Figure 6.

A low-drift operation modular circuit is shown in Figure 6. It is composed of a common emitter-common grid differential-stage circuit and utility operation A_2. T_1 and T_2 are EDM2E differential transistors with β ⩾ 1,000, while T_3 and T_4 are 3DJ4F matching-node field-effect transistors. A_2 must be a utility circuit consisting of two-gain stages such as FC54, BG308 and 5G24. The detailed parameter specifications are: input oscillating voltage V_{OS} ⩽ 0.3 mV, input bias current I_{OS} ⩽ 25 nA, input oscillating current I_{OS} ⩽ 5 nA, open-loop gain A_{od} > 140 dB, common-mode ratio CMR > 120 dB, input oscillating-voltage temperature drift ⩽ 0.5 μV/°C with an equivalence of low-frequency noise voltage at input end N_V ⩽ 1 μV (peak to peak).

Figure 7 represents the schematic diagram of an emitter feedback data amplifier module. EDM2E super-β devices are used in the input transistor, and A_1 and A_2 are utility operation amplifiers (such as the F010). The output

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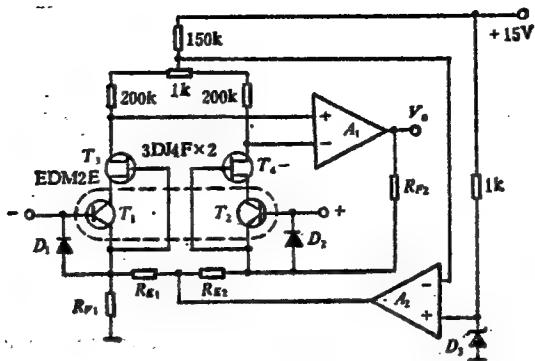
Figure 7.

voltage of the data amplifier feeds back to the input stage emitter through R_{F2}, and the emitter potential follows the input potential. The function of A_2 is to absorb and adjust all the changing currents other than I_{EE}. Emitter resistors R_{E1} and R_{E2} are located on the grid-to-source loop, thus avoiding the situation when the two input ends are suspended and become abnormal due to certain causes. This kind of circuit has excellent specifications: input oscillating voltage $V_{OS} \leqslant 0.3$ mV, input oscillating current $I_{OS} \leqslant 5$ nA, oscillating-voltage temperature drift $\leqslant 0.5$ μV/°C, common mode ratio CMR $\geqslant 130$ dB, off-mode close loop input impedance $Z_1 \geqslant 10^3$ MΩ, close-loop gain linearity no lower than ±0.01 percent and 0.1 to 2 Hz low-frequency noise voltage $N_v \leqslant 1$ μV (peak to peak). This kind of high-precision data amplifier has been widely applied in data gathering and control systems.

In addition to the above applications, high-β and super-β devices are used widely in various circuits such as low-noise video frequency amplifiers, extended time delay simulation synchronizers and high-precision temperature transducers.

13042
CSO: 4008/1056

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APPLIED SCIENCES

INTELLECTUALIZATION OF PRECISION MEASUREMENT INSTRUMENT

[Article by Sun Jing Fan [1327 2533 4345] and Tao Rui Xing [7118 3843 5281],
China Science Academy Shanghai Institute of Optical Instruments: "Intellec-
tualization of Precision Measurement Instrument of Low-loss Reflector and
High-reflection Factor of Raster"]

[Text] The low-loss reflector and the raster are the most basic parts in
various optical systems and laser devices. The precise measurement of the
reflection rate of these reflectors and rasters will contribute very signifi-
cantly to the precision design of various optical systems as well as improve
the operational characteristics of laser devices. The $10.6-\mu$ high-reflection
precision measurement instrument developed at our institute, through expansion-
testing of the optical-source wave-band range (from visible light to ultra-
red), can fully satisfy the above needs with the renovation in increasing the
raster's reflection rate measurement capability and in enhancing the receiver's
sensitivity. Due to the tremendous amount of work involved in the measurement
of the reflection rate and the computation, it becomes necessary to intellec-
tualize the measurement instrument so that the control of the measuring
process, data gathering, data processing and display of results and recording
can be executed automatically. On the basis of this, we equip this measure-
ment instrument with a computer and the appropriate special program and have
obtained excellent results after 2 years of use.

Principle of the Measurement Task

Based on the principle that measurement precision increases with an increasing
number of reflections, the off-axle resonance chamber is employed in the
instrument to establish a multireflection system, along with the integration
sphere technique to eliminate the measurement error possibly caused by the
position deviation of the light beam, as can be seen in Figure 1.

Measurement Control Flow

On the basis of the tuned light path system, depending on the situation of the
sample being in the light path, the special program can be started as soon as
such initial conditions as the number of multiple reflections, number of

Key:
1. Measurement light source
2. Signal light path
3. Monitor light path
4. Reference light path
5. Integration sphere
6. Receiver

Figure 1.
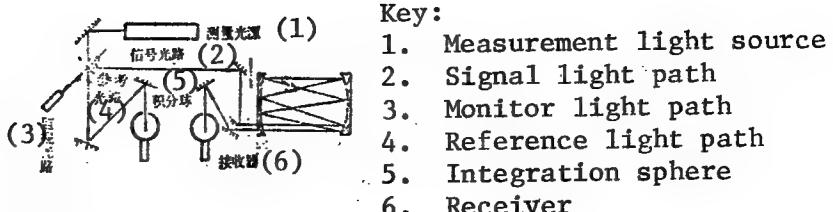
iterative measurements and the measurement format have been given. At this moment under the control of the program, and based on the sequence of the reference light path which measures the multireflection first and then measures the monoreflection, the monitor light path and the signal light path, the measurement instrument will perform automatically the adjustment in the off-axle resonance chamber structure as well as the selection of the light path. It will gather samples automatically and print the value of the sample according to the decision. When the required iterative measurement terminates, it will enter automatically into data processing, and the flow of the measurement ends when the results have been processed either in the form of display or in the form of logging. Figure 2 depicts the system control flow.

Hardware Design

According to the requirement of system design precison and the panelization of computers, we use domestically produced parts to develop a 24-digit mini fixed-point computer which has functions like multiplication, division and shifting, localized operations and an interrupt configuration. The needed hardware condition is provided for the software design using a 20-digit external buffered register as an output. The interrupt configuration and output logic are shown in Figure 3 and Figure 4, respectively.

Software Design

According to the working principle of the instrument and the requirement for intellectualization, we employ the following processing approach in program design:

1. The automatic control of measurement and sample gathering is to be realized according to the hardware condition provided. A panel unit will be used as a logical scale for the preallocated test condition. Hence a press on the start key on the computer can complete the loading of the special program and enter automatically into the automated execution of measurement control, sample gathering, data processing and recording. Its flow of measurement control and sample gathering interface are shown in Figure 5.

2. The program and data are limited to a 1K-byte space through sample preparation and the recycled use of a data store, coupled with the simple but effective selection of high-power radical computation so that the program is compressed sufficiently tight to leave adequate data storage.

Measurement light source

Selection control of light path

Signal light path

Off-axle resonance chamber.

Receipt of ultra-red

Reference light path

Receipt of ultra-red

Maintaining of sample magnification

Measurement controller

Printer

Modulus conversion

Synchronized monitor light path

Optic-electro receiver

Interface circuit

Computer

Number display

Input to machine

Figure 2.

Figure 3.　Interrupt Configuration Logic

Key:
1. Measure signal light path
2. Measure the shift of decimal point
3. Measure reference light path
4. Set 0 control
5. Need to tune light path
6. Need to input
7. Need to print
8. Need to display
9. Need to gather sample
10. Set 1 control
11. Input control
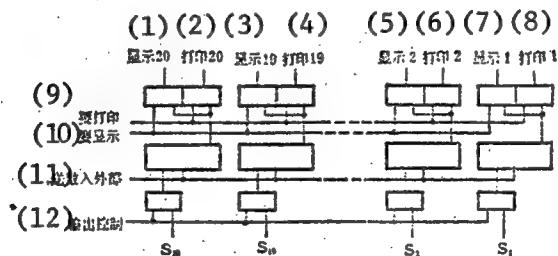
Figure 4.　External Buffered-output Logic

Key:
1. Display 20
2. Print 20
3. Display 19
4. Print 19
5. Display 2
6. Print 2
7. Display
8. Print
9. Need to print
10. Need to display
11. Send data to external area
12. Output control
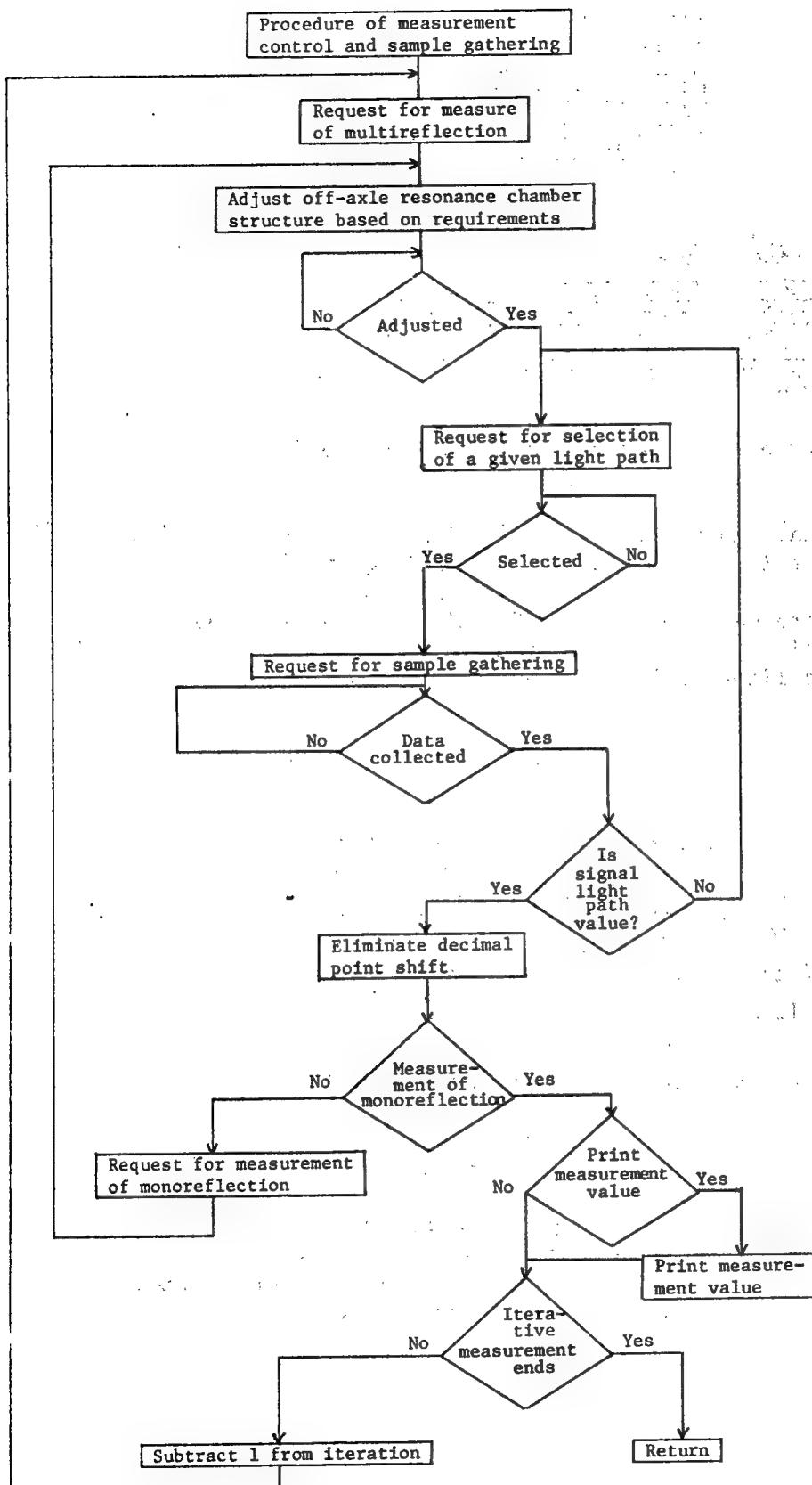
Figure 5. Flowchart Showing Measurement Control, Sample Gathering Interface

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Program start

Set measurement format for this sequence, set iterative measurement number to be 1 and multiple reflection number to be N. Also set printing requirement, standard reflection rate and so on.

Relative measurement

Yes — 1 send number of lens change K

No — Three-lens combination format

Standard reflection rate + ÷ =

No — 1 send number of lens change K

Yes — 3 send number of lens change K

Measurement control sample-gathering procedure

$K - 1 = K$

$K = 0$

No — Stop machine. Start after lens change

Yes

Prepare to compute the result for ith measurement

This measurement valid?

No — Inform error in measurement for this time, $0 = R_i(R_{Ki})$

Yes — Compute and print average value of reflection rate (R_{Ki}), $\ell-1=\ell$

$\ell - 1 = \ell$

Print $R_i(R_{Ki})$

$\ell = 0$

Yes — Inform that this set of measurements is invalid

No — Bypass where error occurred, do

Stop machine, adjust system and remeasure

$\ell = 0$

No

Yes — Print the number of valid measurement

Compute and print average value of reflection rate

Compute and print mean square deviation

Terminate and stop machine

Figure 6. Main Program Flowchart Showing Reflection Rate Measurement

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3. An appropriate proportional factor is selected and integer operations are employed. Thus the computational error is set within 1×10^{-5} magnitude to avoid the impact on system precision caused by a computational error. During the process, timely determination and appropriate action are carried out in such situations as mean square deviation calculations where a significant digit could be lost (e.g., $\sqrt{\Delta x^2}$, $\Delta x^2/\Delta y$, etc.) so that the impact on system precision would be avoided. The execution flow of its main program is given in Figure 6.

13042
CSO: 4008/1056

APPLIED SCIENCES

SELF-QUENCHING STREAMER DISCHARGE CHARACTERISTICS AT EXTREME GAS COMPOSITIONS

[Article by You Tiejian [1429 6993 0256], Yang Baozhong [2799 0202 1813] and Chen Hongfang [7115 1347 5364], Department of Modern Physics, and Tang Xiaowei [0781 1321 1218], Institute of High-Energy Physics, CAS; manuscript received 19 December 1983]

[Text] It has recently been discovered that a self-quenching streamer discharge is produced in filament chambers containing certain gas compositions, and the discharge mechanism has been investigated.[1,2] Because self-quenching streamer discharges have large output signals, a narrow amplitude distribution and a fast rise time, they have been attracting interest. We have made preliminary measurements on this discharge mode.[4] Recently we observed some new phenomena in self-quenching streamer discharges at extreme gas composition, clearly differing from those reported in References 1-3.

Our experiments were carried out in a multiple-filament chamber with an effective area of 20 x 20 cm^2. The anode and cathode filaments were gold-plated tungsten wire 76 μm in diameter in a mutually perpendicular arrangement. The distance between the two sets of filaments was 8 mm. The spacing between wires in the cathode was 2 mm and that in the anode was 10 mm. The cathode had a high negative potential, and the anode signal wire was grounded through a 100 kohm load resistor. We observed the transition of the electrical signal from the proportional mode to a self-quenching streamer mode for different gas compositions. The proportional signal increased as the high voltage was increased, but at a certain voltage a large-amplitude self-quenching streamer discharge also appeared. When the voltage was further increased, the proportional signal disappeared, leaving only the self-quenching streamer discharge, whose amplitude increased slowly as the voltage rose. By the photographic method we were able to observe clearly the development of the self-quenching streamer discharge at the point of incidence of the particles as it expanded from the anode filament toward the place where the particles passed through. Its length was about 1-2 mm. A typical self-quenching streamer discharge pulse signal amplitude at the 50-ohm load resistance was from 50 to 130 mV with a pulse width of about 30 ns and a rise time of about 10 ns. The amplitudes of the proportional pulses and self-quenching streamer discharge are plotted against the voltage in Figure 1. Curves 1-6 are for Ar + CO_2 mixtures in six different proportions.
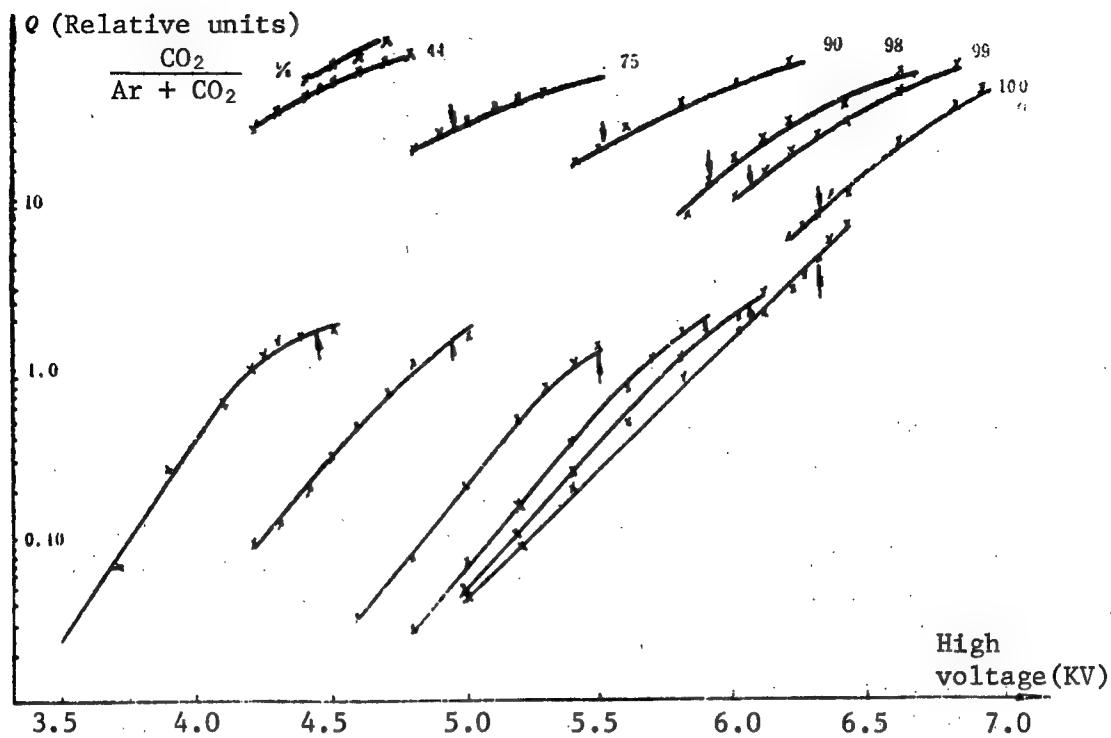
Figure 1. Self-quenching Streamer Discharge Signal Versus Voltage for Different Gas Compositions

The curve with 75 percent CO_2 agrees with that described in Reference 3. But it is stated in Reference 2 that argon has a considerable effect in forming the self-quenching streamer discharge, while Reference 3 states that no large saturation signal was found for CO_2 along; but our results, as presented in Figure 1, show that even in pure CO_2 there was a jump from the proportional discharge to a self-quenching streamer discharge.

The arrows by the curves in Figure 1 indicate the voltages at which the proportional and self-quenching streamer discharges each accounted for half of the total. θ_{tr_1} and θ_{tr_2} represent the relative load values for the proportional and self-quenching streamer discharge signals at voltage U_{tr}. Table 1 gives the values of U_{tr}, θ_{tr_1} and θ_{tr_2} for various gas compositions.

Table 1. Self-quenching Streamer Discharge Signal Versus Voltage for Pure CO_2

$CO_2/Ar+CO_2$ (percent)	44	75	90	98	99	100
U_{tr} (kV)	4.45	4.95	5.5	5.9	6.05	6.3
θ_{tr_1}	1.6	1.5	1.3	2.0	2.3	4.4
θ_{tr_2}	42	25	20	12	11	8.8

It is evident from the table that as the proportion of CO_2 increases, U_{tr} rises and θ_{tr_2} falls, while the observed streamer discharge becomes shorter. Reference 1 states that during the jump from the proportional discharge to the streamer discharge, θ_{tr_1} is almost unaffected by the gas composition ($\theta_{tr_1} \approx 2 \times 10^7$ e). Our observed values for θ_{tr_1} were almost unchanged for a CO_2 content of less than 90 percent, which agrees with Reference 1, but at a CO_2 content of nearly 100 percent, θ_{tr_1} showed a clear increase, reaching a maximum three times the value of θ_{tr_1} for CO_2 concentrations below 90 percent.
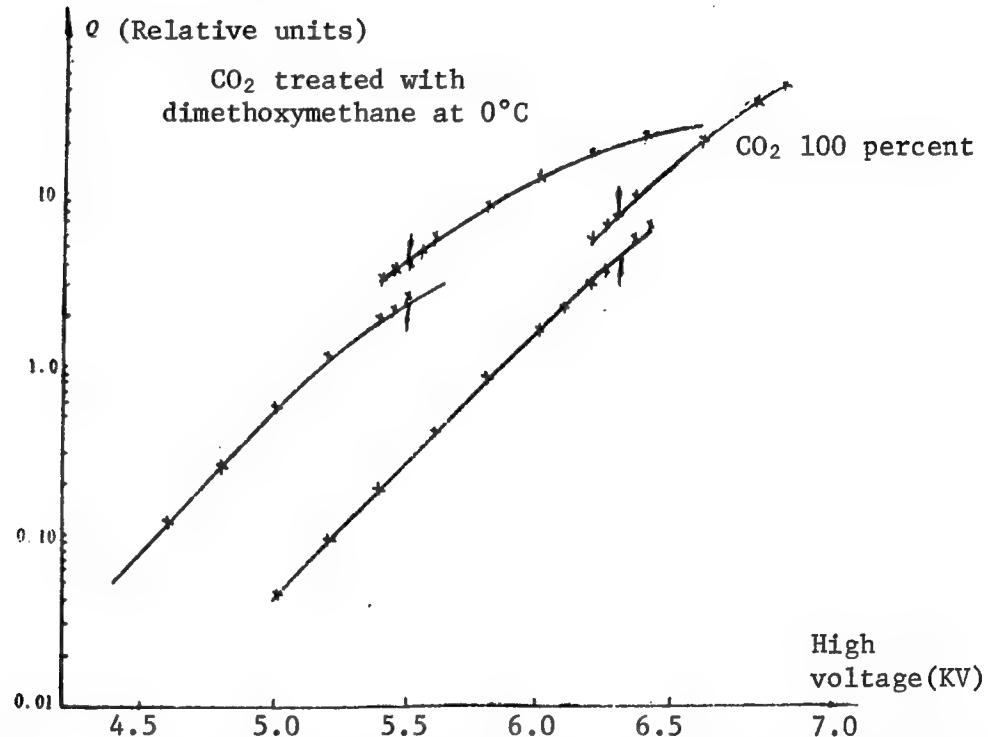
Figure 2. Self-quenching Streamer Discharge Signal Versus Voltage for Pure CO_2

Figure 2 shows a plot of signal versus voltage for pure CO_2 and for CO_2 through which dimethoxymethane was bubbled at 0° C. When the latter gas was used, U_{tr} decreased from 6.3 kV to 5.5 kV, while θ_{tr_2} changed from 8.8 relative units to 4.2 relative units and θ_{tr_1} fell from 4.4 to 2.5 relative units.

The new phenomena that we observed at extreme concentrations were: (1) the presence of a self-quenching streamer discharge in pure CO_2; (2) at extreme values of the $\dfrac{CO_2}{Ar + CO_2}$ ratio, above 98 percent, θ_{tr_1} increased while $\theta_{tr_2}/\theta_{tr_1}$ decreased. These observations disagree with References 1-3. Further investigation of these new phenomena will help to gain an understanding of the mechanism of self-quenching streamer discharges.

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APPLIED SCIENCES

BRIEFS

CHINA'S FIRST CAD SYSTEM FOR CAR BODY--The gracefulness of a small car model
first becomes evident from its exterior design. The computer-aided design
(CAD) system used especially for the design of automobile body exteriors
became available and passed evaluation yesterday [19 October 1983]. Such a
design system is the first of its kind in China. The CAD system for automo-
bile body exteriors was successfully developed under the direction of the
famous mathematician Professor Su Buqing [5685 2975 7230] and through the
joint effort of the Shanghai Tractor and Automobile Research Institute and
the Research Institute of Mathematics, Fudan University. Adopting this new
technology, only three designers in a 2-week period can, through the use of
the computer, produce the large variety of drawings for the exterior of an
automobile, at five or six times the efficiency of manual design and with
more than 10 times the precision. [Text] [Shanghai JIEFANG RIBAO in Chinese
20 Oct 83 p 2]   8174

CSO: 4008/266

PUBLICATIONS

SELECTED TITLES FROM SECOND SYMPOSIUM ON SOLID STATE NUCLEAR TRACK DETECTORS

Shanghai HE JISHU [NUCLEAR TECHNIQUES] in Chinese No 4, Jul 85

[Text] Proceedings of Second National Symposium on Solid State Nuclear
Track Detector

Preparation of CN-8022 Films
        by Lin Yufei [2651 3768 7378] and Ma Lijuan [7456 7787 1227]...... (1)

Etching Methods for SSNTDs
        by Meng Wu [1322 2976]... (2)

Non-Etching Method of Displaying Tracks
        by Hao Xiuhong [6787 4423 4767].................................. (3)

Determination of Etching Properties of CR-39 Plastic Track Detector
  in Different Etching Conditions
        by Huang Rongqing [7806 2837 0615] and Ren Guoxiao [0117
        0948 1321]... (3)

Determination of Etching Conditions for Cellulose Acetate and
  Makrofol-E Plastic Track Detector
        by Huang Rongqing [7806 2837 0615]............................. (5)

Etching Behavior of a CN SSNTD
        by Wang Shicheng [3769 0013 2052] and Cui Huanhua [1508
        3183 5478]... (6)

Comparison Between Different Methods of Measuring Bulk Etching
  Rate for Solid State Track Detectors
        by Huang Maorong [7806 2021 1369] and Zhai Pengji [5049
        7720 3444]... (7)

Effect of Swelling on the Determination of Bulk Etching Rate by
  Fission Fragment Track Diameter
        by Zhai Pengji [5049 7720 3444] and Kang Tiesheng [1660
        6993 4563]... (8)

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HONG KONG MEDIA ON CHINA

CONDITIONS OF OVERSEAS STUDENTS DISCUSSED

Hong Kong PAI SHING SEMI-MONTHLY in Chinese No 102, 16 Aug 85 pp 42-43

[Article by Hsiao Yang [5618 5017]: "China's Overseas Students Resort to All Means to Remain Abroad"]

[Text] Observers of its political situation all feel that China's hopes, to a large extent, rest with its students studying overseas. Not just its second echelon, such as Hu Yaobang and Zhao Ziyang, who are unable to extricate themselves from the ideological fetters of Marx, Lenin, Stalin and Mao Zedong, but those of the third echelon, such as Hu Qili [5170 0796 4539], Wang Zhaoguo [3769 0340 0948], Li Peng [2621 7720] and Hao Jianxiu [6787 1696 4423], are likewise helpless to cast off their ghosts. Only when the present crop of overseas students becomes the masters of the land in the future will China be able to walk on to the path of democracy, freedom, prosperity and strength.

China's Policy on Overseas Students

According to its recent official information, China has since 1978 sent 36,800 students overseas, equivalent to five times the total sent in the 28 years from 1949 to 1977. The annual average of the past 7 years was 20 times that of previous years.

Besides the large increase in the number of students overseas, their area of distribution has also greatly expanded. The overwhelming majority of students sent abroad in the past by the Chinese government went to the Soviet Union and Eastern Europe, but in recent years the students have been proceeding to 63 countries in the world, with the largest number going to America.

Another point needs special mention: Among those going abroad in recent years, the number of students paying their own way occupies a considerable proportion. Not only it had never happened in the 28 years prior to 1978, but it was something unimaginable in the old days. According to figures published by the Chinese government, 7,800 are on their own expense.

Similarity with Taiwan of 20 Years Ago

The "political requirements" on students sent abroad in the past were very stringent, and only those who were found absolutely reliable after a "political investigation" could qualify. Nevertheless, during the "Cultural Revolution," not just the "bourgeois intellectuals" who "came from the old society" and studied in the West and Japan suffered the tribulations of criticism and struggle, but even the "politically reliable" returning overseas students were accused as "Soviet revisionist agents" One can thus see the troubles of what the mainland referred to as "problems concerning the foreign."

Nevertheless, the saying that "things will develop in the opposite direction when they become extreme" began to come true in China. Since the "gang of four" fell from power and Hua Guofeng "stepped aside," China has promoted a series of open-door policies, and its overseas students policy is one of them.

After the reform faction came to power, China departed from the traditional practices of promoting the "class struggle" and isolating itself from the outside and unequivocally declared economic construction as its goal. In terms of personnel training, besides resuming and opening schools of various levels and establishing a regular educational system, it began to send students abroad. As its relations with the Soviet Union and some Eastern European ocuntries were relatively strained, most students went to such capitalist countries as America , Western Europe and Japan.

As discussed above, students going abroad at their own expense was something previously unimaginable as well as a "novelty" for China since the founding of the nation. Beginning in 1978, a handful of them went abroad at their own expense, and the public was not aware of it. Soon afterward, the Chinese government's information organ published an item stating that a certain woman student who, for the purpose of receiving her legacy and studying abroad at her own expense, had left on a certain day for Japan, and so forth. Thereupon, many people, feeling as if they had awakened from a dream, learned that the authorities permitted students to study abroad at their own expense.

By 1980, students studying abroad, both at government expense and on their own, rapidly increased, and their numbers were unprecedented. By then, going abroad to study, the way to make achievements and profit, became a tremendous attraction to the hordes of scholars. College students making fairly good grades, young lecturers and assistants, technicians and researchers all wanted to earn an opportunity to study abroad. Those favored with "overseas connections" tried all means to go abroad at their own expense. For a time, studying abroad became a popular vogue, and the situation was extremely similar to Taiwan of more than 2 decades ago.

Studying Abroad at Government Expense

According to China"s official information, among the 36,800 overseas students in the recent 6 years, the number of government scholarship students was 29,000, constituting about five sixth of the total. Classified by their fields of study, 39.6 percent were in engineering, 28.5 percent in science,

13.1 percent in social science, 11.1 percent in medicine and 7.7 percent in agriculture and economics. According to these figures, about 70 percent of government scholarship students majored in science and engineering, which are needed in China's modernization program. Meanwhile, agriculture, economics and medicine are all of practical use. As for social science, it is not considered a must in the national economic construction. Even while China is opening to the West, their ideologies remain incompatible with each other; therefore, learning the theories and methods of social science taught in capitalist countries will serve no useful purpose. (Such subjects as business management which are useful to China's modernization program are not included among the 13.1 percent in social science.)

According to the above figures, China starts from the practical in sending students abroad. It is in answer to today's urgent need for economic construction personnel, the objective reality.

As implied in the name, there should be no doubt that the state is responsible for the expenses of students sent by it. However, besides underwriting the expenses of some students for a certain number of years (in order to earn a degree), the government sometimes pays only the expenses for 1 year. Thereafter, those on a 1-year scholarship often voluntarily continue their studies at their own expense, either receiving aid from the school or by part-time work.

As China has become more liberal in recent years, government scholarship students no longer have to satisfy the "political requirements," such as party membership, background, class status and overseas connection; therefore, they are fairly superior in quality. Furthermore, they realize that, spending the money earned with the blood and sweat of the people, they must not neglect their studies, for otherwise they will not be able to justify themselves upon returning home. Thus, most of them study hard and make achievements.

According to statistics, more than half of the 15,000 students returning to China in the past few years after completing their studies were on government scholarship. These people have made certain achievements in their professions and produced a certain impact in satisfying the urgent personnel need of the modernization program. However, according to mainland newspapers, some returning students were not given important posts and others were assigned work outside their fields. The reasons are twofold: China's scientific research and production technology are somewhat different from those of the countries where the students studied and, due to problems in the personnel system, plus the mischief of "departmentalism" in some organs, it is difficult to make full use of the talents. Furthermore, the trend of jealousy remains fairly general. Thus, while the returning students possess qualifications as their capital, sometimes they also encounter rejection and attack.

The Policy on Students Going Abroad on Their Own

As discussed above, Chinese students going abroad on their own in the past 6 years numbered about 7,800. Most of them went to America, while there were also Chinese students in Canada, England, France, Japan and Australia.

At one time, China's authorities held different views on the issue of students going abroad at their own expense. However, Deng and Hu of the highest level indicated that there is no harm even if a percentage of them fails to return, because another percentage will return to work for national construction. Recently, mainland authorities viewed the issue from a higher plane: It is not necessary to judge the results of the overseas students policy by whether the students studying at their own expense return or not. Rather, the assessment should be made in a longrange significance. The increase in the number of Chinese in America is favorable to China. This change in policy indicates that mainland authorities are progressing further on the path of enlightenment.

Naturally, same as its practices in other aspects in the past 5 or 6 years, China's overseas students policy was also at times strict and at times lenient, or one may say alternatively tightening and loosening. It was declared at one time, for instance, that undergraduates enrolled in school were not permitted to go abroad, but must first graduate and work for 2 years before applying for permission to go abroad. Then, it was declared that the applications of all lecturers, engineers and physiciansin-charge, the so called "three masters," and key cultural and artistic personnel must be approved by special organs and restricted.

However, early this year, mainland authorities approved a measure to liberalize to a great extent restrictions on students going overseas at their own expense. As long as they have obtained admission certificates from foreign schools and have an assured source of funds, they may apply without restrictions of age and work. In addition, mainland authorities ordered the public security branch to expedite the handling and disposal of passport applications for personal reasons (including studying abroad at one's own expense). It appears that China's doors to the outside are opening ever wider. The problem now is that the American side is creating all sorts of obstacles. Reportedly, seldom 1 out of 10 visa applications is approved.

Some Completing Their Studies and Others Becoming Prostitutes

Unlike students on government scholarship, the conditions of students paying their own way are fairly complex. After completing their studies or upon expiration of the time limit, most students sent by the government returned on schedule. Naturally, some of them changed from government scholarship to paying for themselves and continued their studies or, according to the regulations of their host countries, obtained short-term employment, but the overwhelming majority returned to China sooner or later. Nevertheless, it was not so with those paying their own way. According to actual conditions, most of them did not return. It was one reason for America's refusal to approve visa applications.

Overseas students at their own expense can all be included in one of the following categories.

1. Studying Earnestly. Regardless of their academic background before going abroad, whether they have to attend remedial school for foreign languages or whether they are Ph.D. candidates, some students study conscientiously. In

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terms of their sources of fund, a handful is supported or partially supported by friends and relatives abroad, while others either work part time or receive aid from school. Those who must work to pay their way have the hardest time, because it is not easy to study and work at the same time.

2. Working after Graduation. Some students have earned a degree and found a job. Among those, some are seeking the opportunity for permanent employment (or change of their student status), and others plan to find a school to continue their studies or remain in the same school for advanced studies.

3. Not Studying at All. Some either have no intention to study at all, or, because of financial, language or class work difficulties, are unable to continue. Thus, they drift along in society, mostly trying to earn money. Most of them have become illegal immigrants.

4. Using Studying as a Cover. Unwilling to lose their legal student status, yet unable to handle their studies or wishing to earn more money, some students enroll in "irregular schools," paying the tuition but never coming to class, or attending class occasionally and going through the motions. They earn money while maintaining their legal status. Naturally, they learn nothing, but are only biding time for opportunities.

5. Utilizing Opportunities to Change Status. Some students use studying as an excuse to go abroad and, once they succeed or have done some studying, try to find a way to change their status. Marriage is a shortcut. Most countries are fairly lenient to those applying for an immigrant status because of marriage. Thus, some single students or students divorcing after going abroad follow the path of marrying local overseas residents or citizens to acquire residence. Besides using marriage as the means to become a legal immigrant, some obtain the sponsorship of firms and apply as commercial immigrants. Generally speaking, instances of single women students obtaining resident status through marriage are most numerous.

In short, overseas students on their own consist of all kinds, each going his own way, including Ph.D.s working in large firms and dancing girls or prostitutes. Such enormous disparities are nothing surprising in the fiercely competitive capitalist society.

Many overseas students on their own consider studying abroad as "learning" which is also similar to Taiwan's conditions. In terms of Taiwan's overseas students, some 6,000 a year come to America, but not more than 20 percent return to Taiwan.

China's Overseas Students Policy and Its Prospect

As a whole, sending large numbers of students abroad on government scholarship and permitting students going abroad on their own in recent years are manifestations of liberalization in policy and helpful to the modernization program. These need no elaboration. Though the impact of sending students abroad cannot be seen for a time, it will be felt with the passing of time. The returning students of the fifties, for instance, are playing a considerable role on the mainland. Thus, sending large numbers of students

abroad will have a definite impact on politics and the economic construction.

However, China's overseas students policy should be given further consideration and improved. There is, for instance, the problem of studying for the purpose of application. As China has always given fairly serious attention to science, the proportion of science students is rather high. While science has its importance, in view of the pressing need of its industrialization today, China should increase the proportion of engineering students and enlarge the numbers of those majoring in information technology and basic engineering, while further cutting down on the number in social science.

Another problem is that, in terms of practical results, it seems more desirable to use the same amount of foreign exchange to invite foreign experts to teach on the mainland instead of sending students abroad. Of course, it does not mean that sending students abroad is undesirable, but we feel that reducing the amount spent on overseas students majoring in impractical fields and shifting to foreign experts teaching in China are more worthwhile.

There is another objective problem of a far-reaching influence: the large number of children of high-level cadres studying abroad (mainly in America). As the systems and ideologies of America and other capitalist countries are very different from China, the influence of these high-level cadres' children returning home after living a long time in capitalist countries indeed deserves careful exploration, because, unlike ordinary citizens, many of them may one day become successors.

In short, so long as the open-door policy remains unchanged and nothing dramatic occurs in Sino-U.S. relations, China's policy on overseas students paying their own way will not change much. It is hopeful that more students will proceed to the Western world in the coming years.

6080
CSO: 4005/1443

Acoustics

AUTHORS: ZHOU Xianwen [0719 3759 2429]
           JIE Shu [6043 6615]

ORG: Institute of Acoustics, Chinese Academy of Sciences

TITLE: "BGO SAW Reflective-Array Compressor"

ABSTRACT: The surface acoustic wave (SAW) grating pulse compression filter
(RAC device, or reflective array compressor) produces chromatic dispersion
delay lines. By reflecting SAW on a train on the grating, a chromatic disper-
sion time lag is produced. The RAC device has the characteristics of a long-
term lag, large bandwidth, low parasitic signal and compressibility, etc. In
addition to the above-mentioned characteristics, the RAC device based on
bismuth orthogermanate is more suitable for fabricating miniaturized device
with a long-term lag. The paper describes such a RAC device for fast fre-
quency spectrum analysis; the RAC includes an expander and a compressor. One
table lists the measurement data for the RAC device. Four figures show the
groove depth distribution of the grating array of the expander, phase devia-
tion of the frequency response (and pulse response) of the compressor, and a
pulse compression waveform of the RAC device. The authors thank Wang Chenghao
[3076 1987 7685] for his assistance, and Chen Dongpei [7115 2639 1014], Shen
Qingfeng [3947 1987 7685],Wei Yulan [7614 3768 5695] and Xia Shuying [1115
3219 5391] for taking part in the experiments. The paper was received for
publication on 20 June 1984.

AUTHOR: QU Cunrang [2575 1317 6345]

ORG: Institute of Acoustics, Chinese Academy of Sciences

TITLE: "Pattern Recognition of Radiated Ship Noises"

ABSTRACT: The paper utilizes pattern recognition techniques to classify ships
navigating in a channel by categories. According to second-order statistical
characteristics—autocorrelation function of radiated ship noises, the author
and his colleagues derived four characteristic quantities. The autocorrela-
tion function is statistically stable in the time domain; in addition, the
gain of an optimal time-space joint processing system based on sonar techniques
can be used to good advantage. Statistical decision theory can be used to
classify radiated noises of three ship categories: (1) large passenger liners
and freighters from thousands of tons to the 10,000-ton class; (2) tugboats
and transport vessels of hundreds of tons; and (3) small transport boats and
fishing boats. By the pattern recognition using characteristic quantities,
the error rate is 9 percent for category (1) ships as shown in one of the four
tables. The error rate is 21 percent for categories (2) and (3) vessels as
shown in another table. Two other tables list data showing numerical charac-
teristics during training. Five figures show the definitions of the character-
istic quantities and its distributions in two-dimensional space for different
categories of vessels. The author thanks Xu Zhengyong [6079 4394 6978] for
his suggestions. The paper was received for publication on 16 May 1983.

AUTHORS: YUAN Yiquan [5913 2496 0356]
             SHEN Shoupeng [3088 1108 1756]

ORG: YUAN of Nanjing Engineering College; SHEN of Shanghai Institute of
             Organic Chemistry, Chinese Academy of Sciences

ABSTRACT: Through the development of an underwater acoustic imaging PVDF-DMOS
integrated reception transducer, new underwater applications of high polymer
piezoelectric thin film, and the oscillation mode (of the transducer thus
constructed) are analyzed. An electromagnetic circuit diagram is shown in one
of the six figures. Factors affecting device sensitivity are analyzed. Mea-
surement results are presented and device properties are evaluated. The paper
can serve as a reference in designing PVDF piezoelectric transducers and trans-
mitters. Five of the six figures show the operating principle of the acousti-
cal structure, an electric waveform subjected to step-jump pressure, an ideal
response curve for reception sensitivity varying with frequency, a PVDF-DMOS
structural equivalent diagram, and a theoretical and measured orientation
diagram. Four tables list the data of acoustical properties, physical con-
stants of PVDF, piezoelectric crystals and ceramics, properties of different
thickness in the cemented layer, and measured characteristic indexes of a
PVDF-DMOS transducer. The paper was received for publication on 5 August 1983.

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AUTHORS: FAN Baigang [5400 4102 0474]
            YE Shigong [5509 1709 0361]
            FENG Ruo [7458 5387]

ORG: Institute of Acoustics, Nanjing University

TITLE: "Ultrasonic Pulse Measuring System in Low Frequency Range"

ABSTRACT: In medicine, ultrasonic frequencies in hundreds of thousands to
several megacycles per second are often used in applications. In this fre-
quency band, the study of the ultrasonic property of the biological medium
is important in biological medicine. The paper presents a low frequency (0.25
to 4 MHz) ultrasonic pulse testing system based on the substitution-principle
method. The diffraction effect is calculated via the substitution method in
order to quantitatively discuss calibration of the diffraction effect.
Measurement results for castor oil are given. One table lists the ultrasonic
absorption coefficient of castor oil. Five figures show an illustrative
diagram of the mechanical portion of the measuring system, system displace-
ment of measuring tank and transducer, circuit block diagram, additional
attenuation induced by diffraction effect and relationship between speed
ratio of two liquids, and absorption coefficient of castor oil. The study
began in 1979 and was completed in the first half of 1981. The authors thank
Professor Wei Rongjue [7614 2837 3635] for his guidance, and the funding com-
mittee of the Chinese Academy of Sciences for its financial assistance.

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CSO: 4009/277

AUTHOR: NI Chaozhou [0242 2600 0719]
          MA Yilin [7456 4135 2651]
          SUN Cuifang [1327 4733 5364]

ORG: Shanghai Institute of Organic Chemistry, Chinese Academy of Sciences

TITLE: "Crystal and Molecular Structure of $\{[(C_6H_5)_3P]_2Cu\}_2B_{12}H_{12}$"

TEXT OF ENGLISH ABSTRACT: The crystal and molecular structure of $\{[(C_6H_5)_3 P]_2Cu\}_2B_{12}H_{12}$ has been determined from three-dimensional single-crystal X-ray data.   The compound crystallizes in the triclinic space group $P\bar{1}$, with $a = 12.134(3)$, $B = 15.521(3)$, $c = 11.236(3)$Å; $\alpha = 94.41(2)°$, $\beta = 115.41(2)°$, $\gamma = 103.47(2)°$ and $Z = 1$.   The structure was solved by the Patterson-heavy-atom and Fourier methods, and refined by block-diagonal least-squares techniques to a final R of 0.084 for 3699 independent reflections.   The $B_{12}H_{12}^{2-}$ cage is situated at the center of symmetry and two bis (triphenylphosphine) copper (I) are centrosymmetric about the $B_{12}H_{12}^{2-}$ cage.   The $B_{12}H_{12}^{2-}$ cage ligand binds to two centrosymmetric copper atoms by means of Cu-H-B-B-H chelate rings. Each copper atom is further bonded to two triphenylphosphine ligands and the coordination of the copper atom is nearly tetrahedral.   The average distance of B-B within the $B_{12}H_{12}^{2-}$ cage is 1.78Å and the average value of B-H is 1.16Å.   The average distances of Cu-P and Cu-B are 2.270(4) and 2.39(2)Å respectively, while the distances of the two Cu-H in the chelate rings Cu-H-B-B-H are 1.82 and 1.88Å respectively, and the five atoms of the chelated ring Cu-H-B-B-H are almost coplanar.   (Paper received 9 April 1984.)

AUTHOR: LIN Yunqing [2651 0061 7230]*
          JIANG Yuanbin [1203 6678 2430]
          SUN Shuhai [1327 2885 3185]
          et al.

ORG: Changchun Institute of Applied Chemistry, Chinese Academy of Sciences

TITLE: "The Stereospecific Polymerization of Butadiene with Co(acac)₃-
Al(i-Bu)₃-Sulphur Compound Catalyst System and Its Possible Mechanism"

TEXT OF ENGLISH ABSTRACT: Effects of the $i-Bu_2AlCl/i-Bu_3Al$, $i-Bu_3Al$/butadiene
and S/1 molar ratio, the addition of acetonitrile and of various sulphur
compounds (S) on the catalytic activity of $Co(acac)_3(1)-Al(i-Bu)_3$-sulphur
compound catalyst system in the polymerization of butadiene were investigated.
The polymer obtained was shown to be syndiotactic, having a high vinyl content
(>97 percent) and high melting point (>200°C) by DSC, X-ray diffraction
patterns and infrared spectral analysis. Based on the behavior of the sulphur
compound a possible mechanism of the syndio-1,2-polymerization of butadiene
is proposed. (Paper received on 29 March 1984.)

* Correspondent

AUTHOR: HU Banghao [5170 6721 6725]*
          SHA Huai [3097 2037]
          YU Dongfang [0060 2639 7089]
          et al.

ORG: HU of Wuhan Institute of Physics, Chinese Academy of Sciences;
SHA, YU, et al., of the Wuhan Unit General Hospital, PLA

TITLE: "Studies on the Anti-fertility Constituent of the Flower Yuan-hua:
Isolation and Structure of Yuanhuatine"

TEXT OF ENGLISH ABSTRACT: A new diterpene orthoester, yuanhuatine, $C_{34}H_{36}O_{10}$,
m/z: 604 (M^+), $[\alpha]_D^{3.0}+$ 112.1° (c0.390, $CHCl_3$), white amorphous powder, has
been isolated in 0.0047 percent yield from the alcoholic extract of the
Yuan-hua flower (Thymelaeaceae, Daphne genkwa Sieb. et Zucc.). The structure
of yuanhuatine was shown to be 2 according to the spectral analysis and in
comparison with the known compound 1. The abortifacient minimum dose of 2
in monkeys was shown to be 50 µg/animal and $LD_{50} = 3.02 \pm 0.12$ mg/kg.
(Paper received on 5 January 1984.)

*Correspondent

AUTHOR: LI Xingfu [2621 6821 1133]*
            FENG Xizhang [7458 6932 3864]
            XU Yingting [1776 5391 1656]
            SUN Pengnian [1327 7720 1628]
            SHI Jie [0670 2638]

ORG: LI, FENG and XU of the Application Department, Institute of High
Energy Physics, Beijing; SUN of the University of Science and Technology of
China, Hefei; SHI of the Petroleum School, Tianjin University

TITLE: "'Saturate Packing' and 'Uniform Packing', Structural Characteristics
in Lanthanide Coordination Compounds"

TEXT OF ENGLISH ABSTRACT: The structural characteristics were found by
mathematical treatment on more than 130 lanthanide coordination compound
structures.

1. A region of packing saturation exists with the average SAS value of 0.78
and a standard deviation of 0.05, thus demonstrating an equilibrium between
steric effects and the ligand field interaction. The former dominates above
the "packing saturation" region and the compound tends to dissociate or to
decompose. A bonding effect prevails below the saturate region with the
effects of association, bridging or reactions which tend to increase the
steric crowding around the metal center.

2. The vector sums of coordinating ligands in each structure approach zero,
with the average value of $|\Sigma SAF \cdot \vec{r}|$ of the 130 structures equal to 0.02 and
the standard deviation 0.015. It is therefore suggested that the gravity
center of the first order ligand packing tends to coincide with the metal
center. Such a phenomenon can be explained by the fact that bonds between
metal and ligands are almost unidirectional, whereas steric repulsion among
the ligands leads to a uniform distribution. Therefore, the conclusion is
reached that, in weak bonding compounds, molecular geometry is not one which
favors bonding to the maximum but rather one which reduces the local steric
tension to the least extent. (Paper received 28 July 1984; revised 4 December
1984.)

* Correspondent

9717
CSO: 4009/1128

AUTHOR: ZHOU Bizhong [0719 1801 1813]
          CHEN Shibo [7115 0013 1591]
          CAI Yaoqiang [5591 6460 1730]
          et al.

ORG: Department of Physics

TITLE: "Irradiated Defects and Their Influence on Optical Electronic Properties in GaP(N)"

TEXT OF ENGLISH ABSTRACT: Irradiated defects and their influence on the optical-electronic properties in 1 MeV electron-irradiated GaP(N)LED were investigated using the EL spectrum, photocurrent spectra and CL analysis. A new radiation center was found in irradiated GaP(N)LED. It was shown that the luminescence efficiency was decreased due to the presence of the non-radiation centers and partly due to the energy dissipation effect for some radiation centers in the irradiated samples. The nature of the defect centers was analyzed as well. Finally, it is pointed out that V_{Ga} and some residual oxygen atoms are unfavorable defects and impurities, respectively. (Paper received in March 1985.)

AUTHOR: ZHOU Taijin [0719 3141 6930]
          WANG Nanqin [3769 0589 6953]

ORG: Department of Chemistry and Institute of Physical Chemistry

TITLE: "The EHMO Calculation Method of Group Decomposition and Its Program
for Microcomputer"

TEXT OF ENGLISH ABSTRACT: The EHMO group decomposition calculation program,
which has been successfully used on the IBM PC/XT microcomputer, is introduced.
The characteristics of the program are as follows: By inputting atomic
coordinates the point-group of the molecular system and irreducible representa-
tion can be obtained; the symmetry-adapted linear combinations of atomic
orbitals can be set up and then the overlap matrix and Hamiltonian matrix
can be diagonalized according to irreducible representations; finally, for
the symmetric molecules, the secular equation with lower dimensions can be
set up and the space of storage for matrix allocations and calculation time
can be greatly saved.

The calculated results are classified according to irreducible representation
of the molecular point-group, and it is thus convenient to analyze data by
means of group theory and correlate with experimental spectroscopic data,
etc. The program is universal and can be applied to all molecular systems
with point groups from asymmetrical C_1 to the highest symmetrical k group.
(Paper received in January 1985.)

AUTHOR: YE Zhencheng [0673 2182 2052]
          CHEN Weiqi [7115 0251 3825]
          SU Xianze [5685 6343 3419]
          et al.

ORG: YE and CHEN of the Department of Oceanography, Xiamen University;
SU, et al., of the Third Institute of Oceanography, National Bureau of
Oceanography

TEXT OF ENGLISH ABSTRACT: A method for simultaneous separation and measurement
of ^{210}Pb and ^{226}Ra was developed and applied to the core sample from
station 81017 in Xiamen Bay. The sediments were leached with 6N HCl and
dilute H_2SO_4 solution. ^{210}Pb and ^{226}Ra were separated by forming insoluble
$Ba(Ra)SO_4$ and soluble lead chloride complexes. After separation, ^{210}Pb and
^{226}Ra were purified by anion exchange and EDTA-$NH_3 \cdot H_2O$ mixture. The $PbSO_4$
source made of ^{210}Pb and the $Ba(Ra)SO_4$ source made of ^{226}Ra were determined
by the low background β and α detectors respectively. The profile of ^{210}Pb
and ^{226}Ra in the core sample was obtained. The sedimentation rate was
estimated to be 13.2 cm/y at this station. (Paper received in March 1984.)

AUTHOR: HUANG Kefu [7806 0344 2591]
           LIU Yueying [0491 2588 5391]
           ZHENG Zhonghui [6774 1813 6540]
           et al.

ORG: Department of Biology

TITLE: "Degradation of Medium Constituents and Changes in Allied Enzyme Activities During Growth of Lentinus edodes on Sugarcane Bagasse"

TEXT OF ENGLISH ABSTRACT: Lentinus edodes was cultivated on a medium of sugarcane bagasse supplemented with 18 percent wheat bran. The contents of the main chemical constituents and the activities of some enzymes in the culture were determined at different stages during the mushroom growth. The fungus could utilize a large amount of the medium. At the end of cultivation (200 days) the dry matter was consumed by about 80 percent, and hemicellulose, cellulose and lignin were degraded by 85 percent, 80 percent and 70 percent respectively. The substrates were decomposed dominantly at the early and middle periods of cultivation. Cellulose and lignin were degraded simultaneously. The activities of cellulases and hemicellulase increased progressively from the stage of mycelial growth to that of button forming. Afterward they dropped steeply to lower levels at the beginning of fruitbody harvest and then continuously descended slowly until the end; however, β-glucosidase increased again during the late stage. Polyphenolase and peroxidase appeared only at the stage of mycelial growth. (Paper received in October 1984.)

AUTHOR: ZHU Jinlin [2612 6930 2651]
            WU Hongshi [0702 7703 6624]

ORG: Beijing Vacuum Electron Devices Research Institute

TITLE: "Diffraction Theory and Engineering Calculation of Open Resonators of the Circular and Coaxial Waveguide Types for Gyrotron"

TEXT OF ENGLISH ABSTRACT: Using the transverse-section method, the reflective coefficient of diffraction in the open-end of resonators with slowly varying cross sections under general unsymmetrical mode conditions has been found through the introduction of a "phase correction factor." Diffraction boundary conditions in the open-end are obtained, and can be used to solve multimode problems. Several different types of open resonators are studied, and methods of engineering calculation are also briefly discussed. (Paper received on 3 January 1984; finalized on 10 January 1985.)

AUTHOR: DING Yaogen [0002 5069 2704]
         NIU Delu [6873 1779 6922]
         LI Daokun [2621 6670 0981]
         et al.

ORG: Institute of Electronics, Chinese Academy of Sciences

TITLE: "An S-Band 2.5 MW High-Power Broadband Klystron"

TEXT OF ENGLISH ABSTRACT: In this paper, the design considerations of the
high-efficiency high-gain broadband klystron are described. Its buncher
has been studied using small signal gain and large signal efficiency programs.
The buncher bandwidth of 10 percent with small signal gain greater than 50 dB
can be obtained for the 7-cavity klystron. The bandwidth of 10-15 percent can
be obtained for an 8-cavity klystron. The design methods and measured results
of two types of output circuits are introduced. The bandwidth of the filter
type output circuit is about 7.5-10 percent, and that of the overlapping mode
two gap cavity output circuit is about 10-12 percent. Two types of S-band
broadband klystrons have been constructed and tested. The experimental
results are as follows: The klystron with a filter type output circuit has
1 dB equi-drive bandwidth of 7.5 percent with efficiency of 38 percent and
gain of 43 dB. The klystron with an overlapping mode two gap cavity output
circuit has a 1 dB equi-drive bandwidth of 10 percent. Their output power is
greater than 2.5 MW. (Paper received on 18 January 1984; revised on
7 January 1985.)

AUTHOR: YANG Kun [2799 2492]

ORG: Qianfeng Electronic Instrument Plant

TITLE: "Computer-Aided Design of a Broadband High-Directivity Directional Coupler"

TEXT OF ENGLISH ABSTRACT: By using available theoretical results, a 0.11-2 GHz, -20 dB, dual-directional coupler is designed. The associated practical design procedure and algorithm can be used as a general procedure for designing several types of couplers or MIC transmission lines, provided they have rectangular bounds. Experimental results show they are in good agreement with theoretical ones. (Paper received on 13 January 1984; finalized on 24 January 1985.)

AUTHOR: PAN Jianqiang [3382 1696 1730]

ORG: Computer Science Department, Fudan University

TITLE: "B Spline Algorithm for Geometric Transformation of Digital Image and Hard-wired Implementation"

TEXT OF ENGLISH ABSTRACT: The algorithm using the B spline function for the geometric transformation of a digital image is presented. Given a group of special regular controlling points, the B spline function for transformation is formed. The algorithm guarantees precise correspondence between controlling points and higher precision can be obtained. It can be implemented in a minicomputer digital image processing system with a special hard-wired device.

This paper also points out that the geometric window transformation can be implemented automatically. (Paper received on 27 December 1983; revised on 29 October 1984.)

AUTHOR: SUN Yuping [1327 3022 1627]
            ZHU Wenzhen [2612 2429 3791]
            LIANG Junhou [2733 0193 0624]
            et al.

ORG: Institute of Semiconductors, Chinese Academy of Sciences

TITLE: "Irradiation Damages in Electron Beam Lithography"

TEXT OF ENGLISH ABSTRACT: The irradiation damages to Al gate MOS capacitors
in electron beam lithography (EBL) and the effects of annealing on damages
at low temperatures (<500°C) are given. The degrees of damage depend on the
electron energies (10-30 keV) and the charge dosages (10^{-6}-10^{-3} $C \cdot cm^{-2}$). The
research on the effects of high energy (30 keV) and large dosage (10^{-3} $C \cdot cm^{-2}$)
on damage is important and useful to EBL with and without vapor development.
The damages of concentrations of interface states can reach one to two orders
of magnitude. Under constant charge dosages, the damages of flat-band
voltages are independent of the variations of the electron energies in
certain energy ranges; and under constant electron energies the damages
of concentrations of interface states are independent of the variations of
charge dosage in certain dosage ranges. The annealing can eliminate the
damages of the flat-band voltages, but can not eliminate completely the
damages of the concentrations of the interface states. (Paper received on
23 January 1984; finalized on 28 January 1985.)

AUTHOR: PENG Ruiwu [1756 3843 0124]
XU Chenmei [1776 2525 2734]
WANG Bohong [3769 0590 1738]
et al.

ORG: PENG, XU, et al., of Shanghai Institute of Metallurgy, Chinese Academy of Sciences; WANG of Shanghai University of Science and Technology

TITLE: "The Cadmium Incorporation and the Preparation of p-n Junction Materials in the Ga-AsCl$_3$-H$_2$ System"

TEXT OF ENGLISH ABSTRACT: The incorporation and behavior of a Cd impurity in VPE of GaAs were studied using elemental Cd as a dopant in the Ga-AsCl$_3$-H$_2$ system. The distribution coefficient of Cd and its solubility in GaAs were found to be 0.01-0.001 and 4×10^{18} cm^{-3} respectively. The relationship between the electrical properties and epitaxial parameters is discussed. As a result, the epilayers with p-n or p$^+$-p-n junctions have been prepared using elemental S and Cd doping techniques. The materials obtained in this way have a smooth surface morphology and good interfacial properties. (Paper received on 12 December 1983; finalized on 13 August 1984.)

9717
CSO: 4009/1122

AUTHOR: XIE Yigang [6200 0001 1481]

ORG: Institute of High Energy Physics, CAS

TITLE: "Rapidity Correlation of Forward-backward Multiplicities"

TEXT OF ENGLISH ABSTRACT: The correlation of forward-backward multiplicities about 9×10^4 events under minimum-bias trigger condition of UA-1 experiment on 540 GeV proton antiproton collider at CERN is reported. Different cut-off conditions and different acceptance correction methods of UA-1 central detector are selected in order to obtain flater rapidity distribution. The correlation strength of short, long, full and fragmentation range is given. Correlation between regions which are symmetrical and unsymmetrical to the plane with axial angle $\theta=90°$ is discussed. The correlation strength in short range forward-backward regions with equal charge is compared with that of opposite charge. All results are compared with other works and with some theoretical models.

AUTHOR: XIE Jialin [6200 1367 7792]

ORG: Institute of High Energy Physics, CAS

TITLE: "On the Average Luminosity of Electron Positron Collider and Positron-producing Energy"

TEXT OF ENGLISH ABSTRACT: In this paper, the average luminosity of linac injected electron positron collider is investigated from the positron-producing energy point of view. When the energy of the linac injector is fixed to be less than the operating energy of the storage ring, it has been found that there exists a positron-producing energy to give optimum average luminosity. Two cases have been studied, one for an ideal storage ring with no single-beam instability and the other for practical storage ring with fast head-tail instability. The result indicates that there is a positron-producing energy corresponding to the minimum injection time, but this does not correspond to the optimum average luminosity for the practical storage rings. For Beijing Electron Positron Collider (BEPC), the positron-producing energy corresponding to the optimum average luminosity is about one tenth of the total injector energy.

AUTHOR: SHEN Wenqing [3088 2429 1987]
        ZHU Yongtai [6175 3057 3141]
        JIANG Chenglie [1203 2110 3525]
        et al.

ORG: SHEN, ZHU, et al. of the Institute of Modern Physics, CAS; JIANG of
the Institute of Atomic Energy, Beijing

TITLE: "Research of Relaxation Process Induced By 80.6 MeV 16O on 27Al"

TEXT OF ENGLISH ABSTRACT: The decreasing coefficients of the angular
distributions, the charge distributions and the first and second moments of
the charge distributions with variation of TKEL are deduced from the results
of the measurement of projectile-like fragments produced by 80.6 MeV 16O on
27Al. The relaxation process of this reaction is analyzed, the effects of the
potential energy surface on the first and second moments of charge
distributions are discussed.

12949
CSO: 4009/9

Mathematics

AUTHOR: LIU Guangyu [0491 0342 5940]

ORG: Air Force Meteorology College

TITLE: "Spectral Decomposition of Multiple Commutative Multiplication Operators"

ABSTRACT: This paper extends the concept of Apostol's decomposable multiplication operators and Wang Shengwang's [3769 5116 2598] unit decomposable operators to the situation of multiple commutative operators. It has been proven that the unit decomposable commuting operator n-row is decomposable. The decomposable commutative multiplication n-operator row is unit-decomposable. Studies were also done on restriction and inducement of super-invariance subspace by decomposable commutative multiplication n-operator row, and the properties of a maximum chain of super-invariance subspace. The first draft of the paper was received on 20 October 1982; the final, revised draft was received for publication on 29 January 1983.

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AUTHOR: SUN Hesheng [1327 0735 3932]

ORG: Institute of Applied Physics and Computational Mathematics

TITLE: "New Criterion Conditions of Rigidity for Surfaces With Mixed
             Curvature"

ABSTRACT: This paper discusses the rigidity problem of generally simply or
doubly connected (monodromy projection) surfaces with mixed curvature. New
rigidity criterion conditions are derived by use of an energy integral. In
particular, the rigidity conditions of a curved surface of revolution can be
briefly expressed by the derivative of the medium $f(\rho)$ of the curved surface:
$f''' > 0$ and $\rho f'' - f' > 0$ with apparent geometric significance. For curved sur-
faces of revolutions, furthermore, a general rigidity criterion condition can
be derived (expressed by the meridian $\varphi(\rho)$ of the curved surface):
$(\varphi'/c\rho)' > 0$ and $(c\varphi'')' > 0$ with $c = c(\rho) > 0$ as a randomly selected function
or constant. The criterion condition not only includes the rigidity condi-
tion derived in References 1 and 2, but also has more wider applicability.
The first draft of the paper was received on 11 December 1982; the final,
revised draft was received for publication on 7 March 1983.

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    lution With Mixed Curvature," SHUXUE NIANKAN [CHINESE ANNALS OF MATHEMA-
    TICS], 2:2 (1981), pp 187-199.

2. Sun Hesheng, "Rigidity Problems of Surfaces With Mixed Gaussian Curvature,"
    in Proceedings of the 1980 Beijing Symposium on Differential Geometry and
    Differential Equations, 3 (1982) pp 1,441-1,450.

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    Surfaces): $\omega_{\eta\eta} + sgn\eta\omega_{\epsilon\epsilon} + \frac{M(\eta)}{\eta^2}\omega = 0$," SHUXUE XUEBAO [JOURNAL OF MATHEMA-
    TICS], 26:1 (1983) pp 88-97.

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    Curvature," ZHONGGUO KEXUE [SCIENCE IN CHINA], 2 (1981) pp 149-159.

5. Sun Hesheng, "On Rigidity Problem of Curved Surfaces With Mixed Curvature,"
    KEXUE TONGBAO [JOURNAL OF SCIENCE], 11 (1981) pp 641-645.

Physics

AUTHORS: GU Benyuan [7357 2609 3293]
            CUMMINGS, H.Z.

ORG: GU of Institute of Physics, Chinese Academy of Sciences;
            CUMMINGS of the Department of Physics, New York City University

TITLE: "Brillouin Scattering Studies of Phase Transitions in Crystals"

ABSTRACT: This paper briefly discusses image phase transition, and phase transition of various solids, summing up more than a decade of experimental studies of Brillouin scattering for numerous crystals. It made reference to H.Z. Cummings, IN LIGHT SCATTERING NEAR PHASE TRANSITIONS, edited by A.P. Levanyuk and H.Z. Cummings (a volume in the series: Modern Problems in Solid-State Physics), North Holland Publishing Company (Amsterdam) (Preprinted). In addition, three categories of typical crystals are discussed: (1) piezo-electric ferroelectric (such as KDP crystal); (2) nonpiezoelectric ferro-electric (such as TGS CRYSTAL); and (3) improper ferroelectric (such as GMO crystal). Also discussed is the order-disorder phase transition. These results illustrate the current level of understanding and the challenge of the structural phase transition. Seven figures show relationships between temperature and static elasticity constant, between temperature and intrinsic frequency of nonattenuation simple harmonic oscillator of two linear couplings, relationships among elastic constant, temperature and electric field measured by the Brillouin frequency shift, as well as relationships between different elastic constants and temperature. Two more figures show a block diagram of typical Brillouin scattering spectrography, and Brillouin scattering spectro-gram of a KDP crystal.

AUTHORS: HUANG Qi   [7806 4860]
             TANG Jingchang [0781 2529 2490]

ORG: HUANG of the Institute of Physics, Chinese Academy of Sciences;
             TANG of the Department of Physics, Zhejiang University

TITLE: "Photoelectron Diffraction"

ABSTRACT: In 1978, synchronized radiation was used by D. Shirley, et al., in
photoelectron diffraction (PhD) experiments conducted for the first time in
high energy range. Then S.Y. Tong, et al., reported that PhD theory can
explain the results of these experiments. Thus, PhD has been recognized as
a new method of analyzing surface structure. This paper outlines PhD in its
general concepts, experimental method, and fundamental theory. Examples
illustrate the use of PhD for studying the surface structures of solids. In
1981, Shirley, Tong, et al., attempted to apply Fourier transforms to normal
photoelectron diffraction (NPD) for direct determination of the surface struc-
ture constants. This approach is still being explored. Seven figures show an
illustrative block diagram of PhD, two exploratory models of photoelectron
spectrum, an NPD spectrum, an illustrative diagram of photoelectron scattering
in crystals, photoelectron wave function, and comparisons between experimental
and theoretical curves of NPD and three-dimensional absorption positions.

AUTHOR: XU Jiren [1776 4480 0088]

ORG: The Institute of Physics, Chinese Academy of Sciences

TITLE: "A Survey of Laser Chemistry"

ABSTRACT: Since lasers were discovered in the 1960's, their applications in
chemistry have received unflagging attention. Because laser wavelengths in
various spectral regions are related to electron and nuclear oscillations in
molecules (or to molecular rotations), interactions of lasers with atoms,
molecules and matter in the condensed state, as well as energy transfer and
matter transformation thus produced are currently the main subject areas of
photophysics and photochemistry. The physical bases of laser chemistry are
the laser's selective excitation, bond selectivity, spatial selectivity, and
time selectivity. Chemical reactions induced by a laser can lead to isotope
isolation, chemical synthesis, material purification, sensitized thermal
decomposition, catalysis, and chain reactions to form long molecular chains,
and thus new products. In addition, lasers may serve in detection of a single
molecule or atom, as well as in monitoring chemical processes.

10424
CSO: 4009/276

AUTHOR: ZHENG Yiyang [6774 0001 7122]

ORG: Institute of Semiconductors, CAS

TITLE: "Uniform Static Field Distribution of Stationary Domain Originated From the Cathode Deep Recess Doping Distribution in GaAs Transferred Electron Devices"

TEXT OF ENGLISH ABSTRACT:

The uniform static field distribution of the stationary domain originated from the cathode deep recess doping distribution in GaAs transferred electron devices is discussed. The uniform field distribution is obtainable if the cathode doping has a cathode deep recess doping distribution. The effect of the doping distribution, the active region length and the diffusion coefficient on the electronic field has been discussed. This kind of domain is compared with the general triangle domain.

AUTHOR: ZHENG Yiyang [6774 0001 7122]

ORG: Institute of Semiconductors, CAS

TITLE: "Experimental Result of Stationary Domain Originated From the Cathode Deep Recess in GaAs Transferred Electron Devices"

TEXT OF ENGLISH ABSTRACT:

The voltage of the avalanche in the high field domain and correlation light emission in GaAs transferred electron devices are discribed. The burnout characteristics of the devices have also been studied. The stationary domains originated from the cathode deep recess are compared with the general triangle domain in GaAs transferred electron devices, thus giving the reason for its existence.

AUTHOR: LI Changjian [2621 7022 0256]
        XU Wenyuan [1776 3306 0337]

ORG: Department of Electronic Science, Nankai University

TITLE: "Optical and Electrical Properties of Hydrogenated Amorphous Silicon-Germanium Alloy"

TEXT OF ENGLISH ABSTRACT:

Amorphous Si-Ge alloys have been prepared by RF sputtering. The optical band gap of a-Si$_{1-x}$Ge$_x$:H films have been measured. The results indicate that the optical band gap decreases monotonically with the increase in x. A linear fit to the experimental data of optical band gap has been made, obtainning composition dependence expressed by the relation $E_g(eV)=1.79-0.98\,x$. The dark conductivity of a-Si$_{1-x}$Ge$_x$:H film at room temperature increases monotonically from 10^{-10} to 10^{-4} cm^{-1}, as the increase in atomic percentage of Ge from 0 to 66%, whereas the dark conductivity activation energy decreases monotonically from 0.84 eV to 0.40 eV.

The alloy composition was determined by the analysis of XPS data. The results indicate that the sputtering rate of Ge is 1.5 times that of Si. The absorption constant $\alpha_{1.2}$ of a-Si:H film and a-Si$_{0.72}$Ge$_{0.23}$:H films has been measured at a photon energy of 1.2 eV. The results indicate that a-Si$_{1-x}$Ge$_x$:H films have more dangling bonds that a-Si:H films. These dangling bonds can be saturated by H.

AUTHOR: WU Huasheng [0702 5478 3932]
        LAO Pudong [0525 3184 2639]
        WU Jiangen [6762 1696 2704]
        et al.

ORG: Department of Physics, Fudan University

TITLE: "Raman Spectroscopic Measurements of Damage Distribution in B$^+$ Implanted Silicon Wafers"

TEXT OF ENGLISH ABSTRACT:

The implanted ions form many kinds of damages in silicon. These damages cut a perfect crystal into crystal particles and relatively large crystalline regions. Using Raman spectroscopy along with anodic oxidation and stripping technique, the authors have measured the stripped thickness dependence of the characteristic Raman peak intensity of B$^+$ implanted silicon wafer, thus obtaining the depth profiles of damage, refractive index and extinction coefficient from analysis. The results are consistent with the other theoretical calculations and experimental data obtained from other methods. In adidition, the depth distribution of the small particles and large particles with bulk property, which may be impossible in ordinary methods, is also detected.

AUTHOR: ZHANG Jingming [1728 2417 2494]

ORG: Institute of Semiconductors, CAS

TITLE: "Analysis of Four-layer Leaky Optical Waveguide in Semiconductors; the Strong Coupling Approximation and the Accurate Solution"

TEXT OF ENGLISH ABSTRACT:

The method of successive perturbation approach for calculating the propagation constants of four-layer leaky optical waveguide in semiconductors is proposed. It extends the calculation range to strong coupling four-layer waveguide. Using the approximate values calculated from a new approximate expression as the initial values, the accurate numerical calculation results are obtained for $t \geq 0.06\,\mu m$ and the method of successive perturbation approach is verified. From the eigenvalue equation, a better approximate expression is deduced. It is suitable for $t \geq 0.2\,\mu m$.

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AUTHOR: WANG Jianqiang [3769 0256 1730]
        WU Xiaoshen [0702 1321 1957]
        LI Mingfu [2621 0682 1788]
        et al.

ORG: Graduate School, University of Science and Technology of China

TITLE: "Deep Centers in VPE-GaAs Grown in Different Atmospheres"

TEXT OF ENGLISH ABSTRACT:

By DLTS measurements, deep levels in n type VPE-GaAs are investigated syste-
matically for epitaxial layers grown in different atmospheres. By comparing the re-
sults of our experiments, it is found that the n type VPE-GaAs grown in Ar atmos-
phere has lower concentration of deep levels than those grown in N_2 atmosphere or H_2
atmosphere. Comparing the mobility measurements reported in our previous work, it
is suggested that the $AsCl_3$-Ga-Ar system is a possible candidate for the production of
high quality devices.

AUTHOR: HAN Jieping [7281 7132 1627]
         WANG Peida [3769 1014 1129]
         MA Junru [7456 0193 1172]
         et al.

ORG: Institute of Semiconductors, CAS

TITLE: "A Study of Ion Implantation Resisted Etching Technique"

TEXT OF ENGLISH ABSTRACT:

A novel technique has been developed for reducing SiO_2 etching rate using ion implantation. Various ions are implanted into SiO_2 layer with diffrent doses. The experimental results show that the higher the dose the lower the etching rate. The key point of this process is dry etching. This result is just opposite from the ion implantation enhanced etching which was reported by many authors under wet etching. The advantages of this technique are good selectivity, high resolution, reagent saving and easy operation.

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CSO: 4009/1007